U.S. Department of Energy

FINDING OF NO SIGNIFICANT IMPACT FOR THE PADUCAH GASEOUS DIFFUSION PLANT FINAL ENVIRONMENTAL ASSESSMENT FOR DISPOSITION OF WASTE AND MATERIALS (DOE/EA-2116)

U.S. Department of Energy, Office of Environmental Management

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) has prepared the *Paducah Gaseous Diffusion Plant Final Environmental Assessment for Disposition of Waste and Materials* (the Final EA DOE/EA-2116), which analyzed the potential environmental impacts of the Proposed Action. The Proposed Action is to manage and disposition approximately 5,050,000 cubic feet (ft^3) of waste and excess material generated from deactivation and other non-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities that will be generated at the Paducah Gaseous Diffusion Plant (Paducah Site) over the next approximately 12 years.

In addition to the Proposed Action, the Final EA analyzed a No Action Alternative, as required by DOE's National Environmental Policy Act (NEPA) regulations (10 *CFR* Part 1021). Based on the analyses in the Final EA, DOE determined that the Proposed Action would not constitute a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an environmental impact statement is not required, and DOE is issuing this Finding of No Significant Impact (FONSI).

PUBLIC AVAILABILITY AND CONTACT INFORMATION: The FONSI and the Final Environmental Assessment (EA) will be available at the following:

- https://www.energy.gov/nepa/doe-environmental-assessments

- U.S. DEPARTMENT OF ENERGY ENVIRONMENTAL INFORMATION CENTER
  Emerging Technology Center, Room 221
  5100 Alben Barkley Drive
  Paducah, KY 42001
  https://eic.pad.pppo.gov/

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PROPOSED ACTION: The Proposed Action is to manage and disposition approximately 5,050,000 ft^3 of waste generated from deactivation and other non-CERCLA activities that will be generated at the Paducah Site over the next approximately 12 years. Wastes could include low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), and nonradioactive Resource Conservation and Recovery Act (RCRA) hazardous waste.[1] In addition, the Proposed Action includes a large volume of excess material at the Paducah Site, namely 1,2-dichlorotetrafluoroethane (referred to as R-114), that may require disposition as a solid waste, should recycle/reuse options not be available. The waste management and disposition activities include waste generation/handling, waste staging and storage, container movement, packaging/overpacking/repackaging, equipment and container sorting, physical volume reduction, equipment and waste container decontamination, marking, labeling, inspection, tracking and inventory, characterization, sampling, treatment, loading, and transporting of Paducah Site wastes to existing off-site DOE and commercial treatment and disposal facilities across the United States, including Arkansas, Florida, Georgia, Nevada, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Utah, and Washington. Mitigation measures may be used to avoid, reduce, or eliminate potential environmental impacts, as discussed in Section 4.3 of the Final EA. However, no mitigation is necessary to render the impacts of this action not significant.

ALTERNATIVES CONSIDERED: In addition to the Proposed Action, the Final EA fully analyzes the No Action Alternative. Under the No Action Alternative, DOE would not perform

[1] As discussed in the Final EA, transuranic (TRU) waste is not anticipated to be generated under the Proposed Action. However, extremely small volumes of TRU waste could be generated that would not affect substantively the transportation risk calculations in the Final EA, worker and public safety and health, or capacity impacts at the Waste Isolation Pilot Plant (WIPP). Any future TRU waste or mixed TRU waste generated at the Paducah Site will be managed in accordance with the Site Treatment Plan and/or existing protocols for contact-handled TRU waste destined for WIPP. DOE would determine at that time whether any additional analysis or NEPA documentation is necessary.

off-site treatment and disposal activities and would continue only on-site waste storage and on-site disposal of nonhazardous, nonradioactive solid waste in the on-site landfill. No new projects that generate LLW, MLLW, or RCRA hazardous waste would be undertaken, and only surveillance and maintenance (S&M) activities would be conducted.

As discussed in the Final EA, DOE also considered a number of other alternatives that were not carried forward for detailed analysis, including on-site treatment of all wastes, off-site treatment of all wastes, on-site disposal of all wastes, and on-site storage of all wastes.

ENVIRONMENTAL CONSEQUENCES: The Final EA considered potential impacts on-site and off-site to land use; geology and geologic resources; soils and prime farmland; surface water; groundwater; floodplains and wetlands; ecological resources; noise; cultural, archeological, and Native American resources; socioeconomics and environmental justice; climate change; waste management; air quality; demography; occupational and public health and safety; and the impacts of off-site transportation. Accidents and intentional destructive acts also were considered both on-site and along transportation routes from the Paducah Site. The analysis in the Final EA is incorporated by reference in this FONSI with a summary provided below.

Under the Proposed Action, there are no or only minimal impacts to on-site and off-site affected environment through air quality, radiation and chemical risk to workers and nearby populations, and accidents and intentional destructive acts.

Air quality impacts on-site and along the transportation routes from the Paducah Site would be negligible, localized, and temporary due to mitigation measures currently being used in the local and regional area.

Chemical risk impacts from normal operations and from accidents and intentional destructive acts to on-site workers from the Proposed Action would be minimal. In the event of a large loss of confinement, such as from seismic natural phenomena, controls, including personal protective equipment and emergency response actions, would maintain impacts below protective action criteria. Chemical risk impacts to the public, from on-site and off-site waste management and disposition activities during normal operations and from accidents and intentional destructive acts, would be minimal with fewer than 1 calculated latent cancer fatality over the life of the Proposed Action to involved workers or the public, including from transportation.

Under the No Action Alternative, the impacts of the Proposed Action, to transport waste off-site for treatment and disposal, would not occur. However, waste generated from S&M activities would continue to be generated and accumulate on-site with the probability of on-site radiation and chemical impacts to on-site workers and the public increasing over time as the volume of on-site S&M waste requiring on-site storage increases.

EXTERNAL REVIEW AND COMMENTS:

On April 30, 2020, DOE sent the Draft EA to host states and host tribes for review and comment, as required by 10 *CFR* § 1021.301(d). DOE considered all comments and, as noted in Appendix F of the Final EA, made revisions to clarify or supplement information in the Final EA in response to several of the comments.

DETERMINATION:

Based on the information and analysis in the Final EA, DOE determines that the proposed action would not constitute a major federal action significantly affecting the quality of human health or the human environment in accordance with DOE's NEPA implementing procedures, 10 *CFR* Part 1021, and the regulations promulgated by the Council on Environmental Quality for implementing NEPA, 40 *CFR* § 1508.27. Therefore, the preparation of an environmental impact statement is not required. DOE approves the *Paducah Gaseous Diffusion Plant Final Environmental Assessment for Disposition of Waste and Materials*, DOE/EA-2116, and is issuing this FONSI.

Issued in Washington, DC, this 27 day of July 2020.

Elizabeth A. Connell
Associate Principal Deputy Assistant
Secretary for Regulatory and Policy Affairs
Office of Environmental Management
Department of Energy

DOE/EA-2116

Paducah Gaseous Diffusion Plant
Final Environmental Assessment for
Disposition of Waste and Materials

U.S. Department of Energy
Portsmouth/Paducah Project Office

June 2020

CLEARED FOR PUBLIC RELEASE

DOE/EA-2116

Paducah Gaseous Diffusion Plant
Final Environmental Assessment for
Disposition of Waste and Materials

Date Issued—June 2020

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

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ACRONYMS

AEA	Atomic Energy Act of 1954, as amended
ALARA	as low as reasonably achievable
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
CRMP	Cultural Resources Management Plan
D&R	deactivation and remediation
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DU	depleted uranium
DUF_6	depleted uranium hexafluoride
EA	environmental assessment
EIS	environmental impact statement
EM	environmental management
EPA	U.S. Environmental Protection Agency
EPHA	Emergency Planning Hazards Assessment
FFA	Federal Facility Agreement
FONSI	finding of no significant impact
FR	*Federal Register*
FTE	full-time equivalent
FY	fiscal year
GHG	greenhouse gas
INL	Idaho National Laboratory
ISCORS	Interagency Steering Committee on Radiation Standards
ISO	International Organization for Standardization
KAR	*Kentucky Administrative Regulation*
KDWM	Kentucky Division of Waste Management
Kentucky	Commonwealth of Kentucky
LCF	latent cancer fatality
LDR	land disposal restriction
LLW	low-level radioactive waste
LOC	loss of contaminant
MEI	maximally exposed individual
MLLW	mixed low-level radioactive waste
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NNSS	Nevada National Security Site
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ODS	ozone depleting substance
ORR	Oak Ridge Reservation
PAC	protective action criteria
PCB	polychlorinated biphenyl
PEIS	programmatic environmental impact statement
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
PSD	prevention of significant deterioration

RCRA	Resource Conservation and Recovery Act of 1976
ROD	record of decision
ROI	region of influence
S&M	surveillance and maintenance
SHPO	State Historic Preservation Office
SRS	Savannah River Site
STP	site treatment plan
TBD	to be determined
TRU	transuranic
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
U.S.	United States
U.S.C.	United States Code
USCB	U.S. Census Bureau
USEC	United States Enrichment Corporation
WCS	Waste Control Specialists LLC
WIPP	Waste Isolation Pilot Plant
WKWMA	West Kentucky Wildlife Management Area
WM	waste management

1. INTRODUCTION

This environmental assessment (EA) has been prepared for disposition of approximately 5,050,000 cubic feet (ft^3) of waste and excess material to support deactivation and other non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) (Public Law 95-510) U.S. Department of Energy (DOE) Environmental Management (EM) activities at the Paducah Gaseous Diffusion Plant (PGDP) site (Paducah Site), a DOE-owned facility in Paducah, Kentucky. This EA has been prepared in accordance with the Council on Environmental Quality (CEQ), DOE regulations, and DOE Orders and guidance to fulfill DOE's requirements for this action pursuant to the National Environmental Policy Act (Public Law 91-190) [Volume 42 of the United States Code Section 4321 *et seq*. (42 U.S.C. § 4321 *et seq*.) (NEPA)].

1.1 BACKGROUND

In 1997, DOE issued the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, DOE/EIS-0200-F (WM PEIS) (DOE 1997a). The WM PEIS was prepared to evaluate management and siting alternatives for treatment, storage, and disposal of five types of radioactive and hazardous wastes, including low-level radioactive waste (LLW); mixed low-level radioactive waste (MLLW) (LLW with hazardous components); transuranic (TRU) waste; high-level radioactive waste; and hazardous waste. The alternatives were evaluated for waste that was stored, disposed of, or to be generated from future operations over a 20-year period at 54 sites, including the Paducah Site. Although the WM PEIS was prepared over 20 years ago, DOE is using some of the analyses in the WM PEIS as the basis for the new analyses in this EA, with appropriate adjustments to factors in the WM PEIS that may be dated, such as population and the dose to latent cancer fatality (LCF) conversion factor.

Subsequent to issuance of the WM PEIS, DOE documented DOE Complex-wide NEPA decisions in applicable records of decision (RODs) regarding treatment and disposal of waste types similar to the waste types historically generated at and to be generated from future activities at the Paducah Site. These RODs are summarized in Table 1. In the 1998 ROD [63 *Federal Register* (*FR*) 41810; DOE 1998a], DOE documented its decision to continue to use off-site facilities for treatment of major portions of the non-wastewater hazardous waste generated, which includes hazardous waste from the Paducah Site (63 *FR* 41811; DOE 1998a). In the 2000 ROD (65 *FR* 10061; DOE 2000), DOE documented its decision for each site to perform minimum treatment on its LLW on-site (65 *FR* 10063; DOE 2000) and to establish regional LLW disposal at two DOE sites, the Nevada National Security Site (NNSS), formerly the Nevada Test Site, and the Hanford Site,[1] for LLW that is generated and shipped (either by truck or rail) by other DOE sites, including the Paducah Site, and meets the waste acceptance criteria of the disposal sites (65 *FR* 10064; DOE 2000). The ROD also included the decision to conduct MLLW treatment at the Hanford Site,[1] Idaho National Laboratory (INL), Oak Ridge Reservation (ORR), and Savannah River Site (SRS),[2] or on-site consistent with Site Treatment Plans, and to establish regional MLLW disposal at two

[1] Per a 2013 ROD, "As stated in the Final Tank Closure and Waste Management Environmental Impact Assessment (EIS), DOE would continue to defer the importation of off-site waste at the Hanford Site, at least until the Waste Treatment Plant is operational. Any future decision to import off-site waste will be subject to appropriate NEPA review." (78 *FR* 75913; DOE 2013). Note that Perma-Fix Northwest is a privately owned treatment facility, not located at the Hanford Site. The provisions of the Settlement Agreement and the ROD limitations against importation of waste to the Hanford Site do not apply to Perma-Fix Northwest.

[2] Shipment of LLW or MLLW to the INL, ORR, and SRS from the Paducah Site is not evaluated in this EA because shipments to these sites from other DOE sites located outside of the host state typically are made on an exception basis after notification to and discussion with the host state regulators. As a result, waste from the Paducah Site is not anticipated to be shipped to the INL, ORR, or SRS.

DOE sites, the NNSS, formerly the Nevada Test Site, and the Hanford Site[1] for MLLW generated and shipped (by truck or rail) by other sites, including the Paducah Site, consistent with permit conditions and other applicable requirements. The 2000 ROD also allowed use of commercial facilities for treatment and disposal of LLW and MLLW consistent with DOE Orders and policy (DOE 2000).

Table 1. Waste Management Programmatic Environmental Impact Statement Records of Decision Issued to Date for Paducah Site Waste Types

Waste Type	Activity	Record of Decision	Decision
MLLW	Treatment	65 *FR* 10061[a]	Treatment at Hanford,[b] INL, ORR, and SRS, or on-site, as would be consistent with current Site Treatment Plans and DOE policy. Decision does not preclude DOE's use of commercial treatment facilities consistent with DOE Orders and policy.
	Disposal	65 *FR* 10061[a]	Dispose of on-site and off-site generated MLLW at NNSS or Hanford.[b] Decision does not preclude DOE's use of commercial disposal facilities consistent with current DOE Orders and policy.
LLW	Treatment	65 *FR* 10061[a]	Each site is to perform minimum treatment on its LLW on-site.
	Disposal	65 *FR* 10061[a]	Dispose of on-site and off-site generated LLW at Hanford[b] or NNSS. Continue to extent practicable disposal of on-site LLW at INL, Los Alamos National Laboratory, ORR, and SRS. Decision does not preclude DOE's use of commercial disposal facilities consistent with current DOE Orders and policy.
Non-wastewater hazardous waste	Treatment	63 *FR* 41810[c]	Continue to use off-site facilities for treatment of major portions of this waste.
	Disposal	63 *FR* 41810[c]	Continue to use off-site facilities for disposal of major portions of this waste.

FR = Federal Register

[a] 65 *FR* 10061 = *Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site*, February 2000.

[b] Per a 2013 ROD, "As stated in the Final Tank Closure and Waste Management EIS, DOE would continue to defer the importation of off-site waste at the Hanford Site, at least until the Waste Treatment Plant is operational. Any future decision to import off-site waste will be subject to appropriate NEPA review." (78 *FR* 75913; DOE 2013). Note that Perma-Fix Northwest is a privately owned treatment facility, not located at the Hanford Site. The provisions of the Settlement Agreement and the ROD limitations against importation of waste to the Hanford Site do not apply to Perma-Fix Northwest.

[c] 63 *FR* 41810 = *Record of Decision for the Department of Energy's Waste Management Program: Treatment of Non-wastewater Hazardous Waste,* August 1998.

All treatment and disposal facilities identified in this EA are existing facilities that have the necessary licenses and/or permits to accept the waste that will be generated at the Paducah Site.

Because the potential impacts at these off-site facilities were considered as part of the licensing/permitting/approval process for these sites, there would be no additional exposure than that expected to the off-site public or on-site workers under these licenses/permits/approvals, and those impacts are not detailed in this EA. In addition, per DOE guidance, while analysis of impacts from a vendor's action may be within the scope of DOE's review obligation, "…the level of detail should be commensurate with the importance of the impacts or issues related to the impacts. If DOE's proposed waste load would be a small part of the facility's throughput and the facility would operate well within established standards, then the vendor's part of DOE's proposal would be low on the sliding [sic] scale, and a statement of this context would adequately characterize the impacts" (DOE 2005). All waste disposition actions will comply with the licenses, permits, and/or approvals applicable to the facilities described in this EA.

In November 2002, DOE completed a *Final Environmental Assessment for Waste Disposition Activities at the Paducah Site, Paducah, Kentucky,* DOE/EA-1339, and issued a *Finding of No Significant Impact, Waste Disposition Activities at the DOE Paducah Site* (FONSI). The 2002 EA supplemented and updated the

previous NEPA evaluation of waste disposition activities conducted as part of the WM PEIS and expanded the scope of the previous analyses to include transportation to commercial facilities across the U.S. (DOE 2002a). Subsequent to the 2002 FONSI and EA, DOE identified an additional volume of material (17,600 m^3) to be dispositioned and completed an EA addendum, DOE/EA-1339-A, for the proposed disposition of this additional waste. DOE issued a FONSI for the additional waste disposition in 2003 (DOE 2003a).

1.2 PROJECT LOCATION

The Paducah Site is located in a generally rural area of McCracken County, Kentucky, approximately 10 miles west of the city of Paducah and approximately 3.5 miles south of the Ohio River, as shown on Figure 1. The boundary of the Paducah Site and the area surrounding the site is shown in Figure 2.

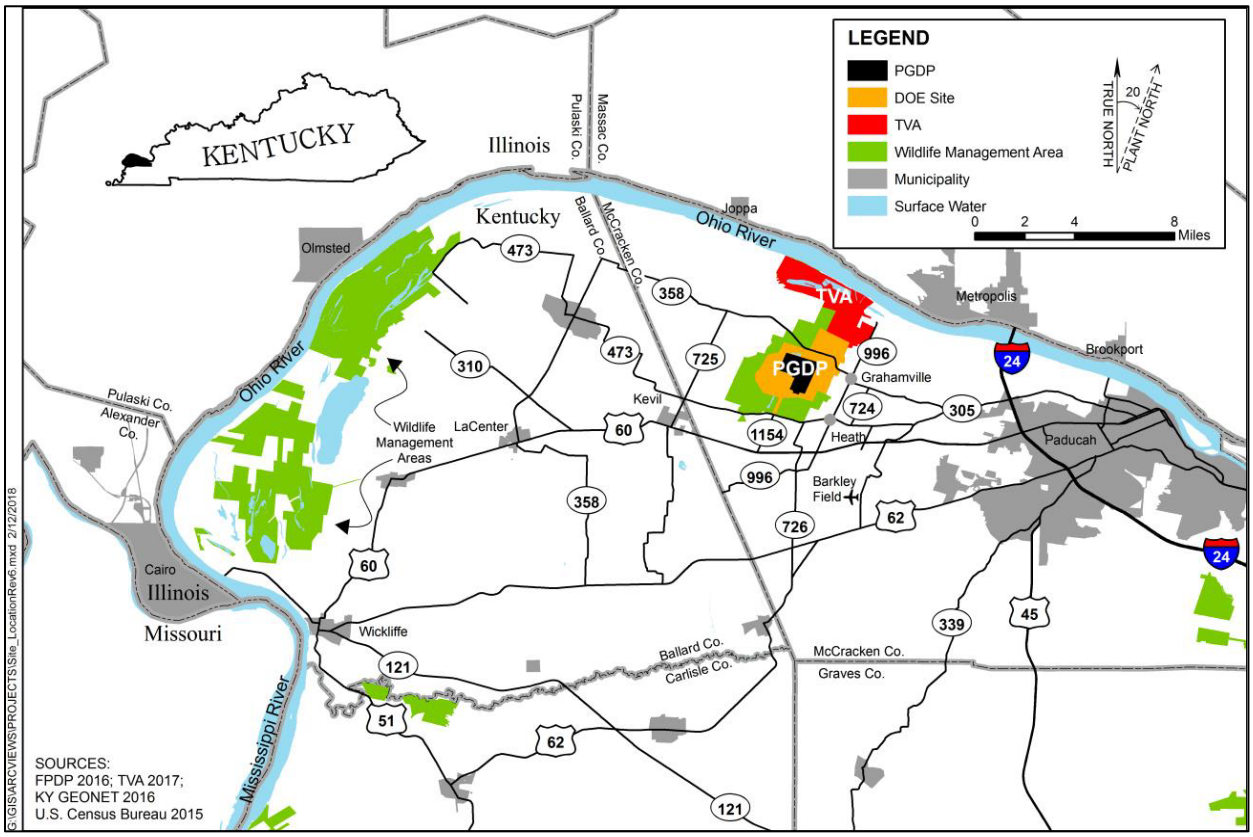

Figure 1. General Location of the Paducah Site

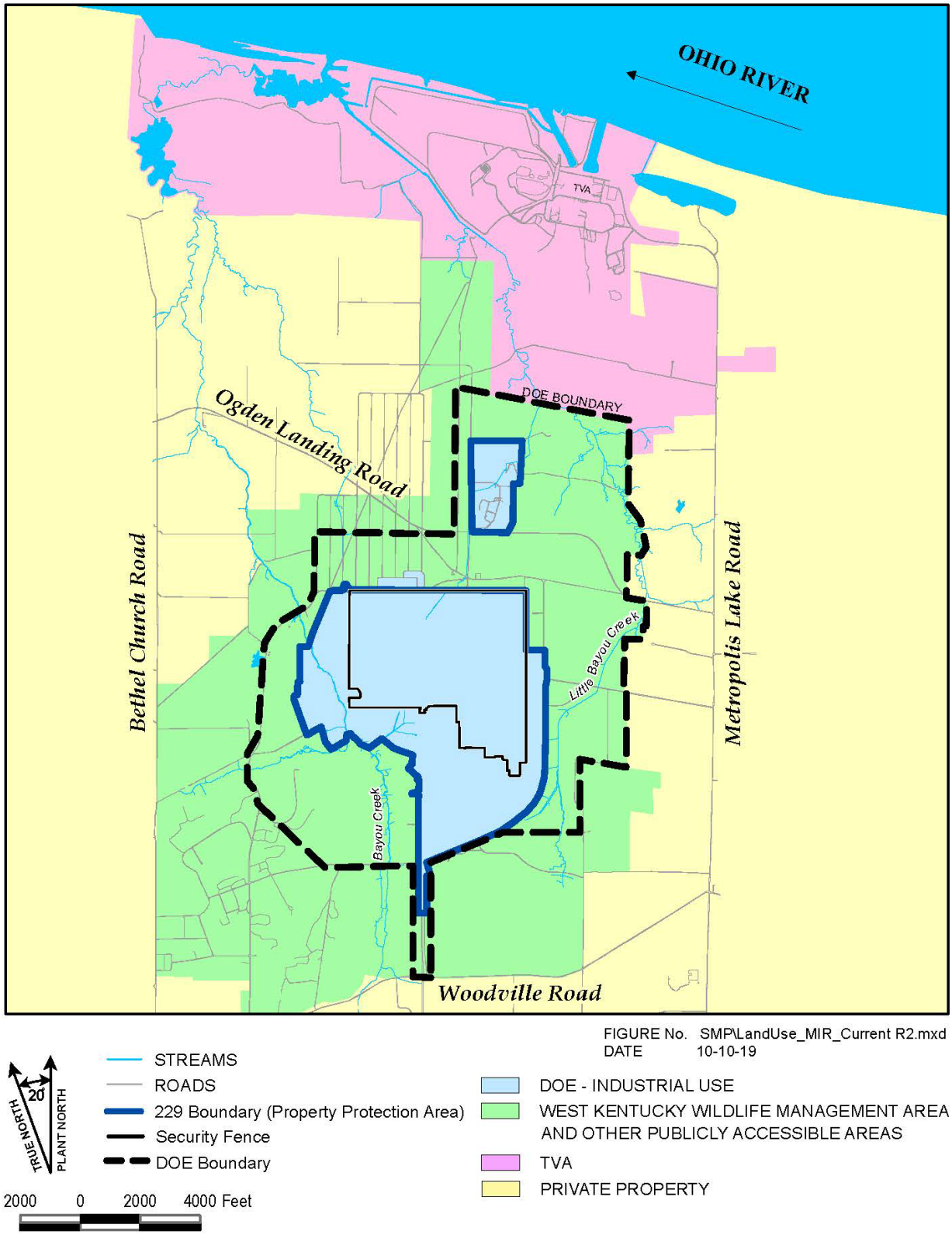

Figure 2. Boundary Layout of the Paducah Site

The Paducah Site began operations in 1952 to produce enriched uranium for further enrichment and eventual use in nuclear weapons production. In 1993, as a result of the Energy Policy Act of 1992 (Public Law 102-486), DOE leased the real property, facilities, and infrastructure necessary for active enrichment operations to United States Enrichment Corporation (USEC), a government corporation that became a publicly held company in 1998. Until 2013, USEC enriched uranium at the Paducah Site to supply nuclear fuel to electric utilities worldwide. In October 2014, USEC returned PGDP leased facilities to DOE control. These returned facilities are undergoing deactivation to prepare for decommissioning. Deactivation is the process of placing a facility in a safe and stable condition that minimizes existing risks and protects workers, the public, and the environment until decommissioning is complete.

1.3 PURPOSE AND NEED FOR ACTION

DOE's purpose for the Proposed Action is to ensure safe, efficient, and compliant management and disposition of waste and material generated from deactivation and other non-CERCLA activities at the Paducah Site in a cost-effective manner as required under federal and state regulations and DOE Orders.

DOE manages the radioactive waste it generates under the Atomic Energy Act of 1954, as amended (AEA) (Public Law 83-703) (42 U.S.C. § 2011 *et seq*.) and applicable DOE Orders. The Resource Conservation and Recovery Act (RCRA) (Public Law 94-580) regulations include a 1-year storage limitation for wastes that are subject to land disposal restrictions (LDRs), but there are special provisions for radioactive mixed waste that allow for longer storage periods in some instances. Although waste types proposed for disposition from deactivation and other non-CERCLA activities essentially are unchanged from the waste types previously evaluated in the WM PEIS (DOE 1997a), FONSI and EA (DOE 2002a), and the FONSI and EA Addendum (DOE 2003a), a combination of the following factors warrants a new EA to evaluate potential impacts:

- Cessation of long-term uranium enrichment activities and subsequent focus on deactivation of the former uranium enrichment facilities that are no longer being used at the Paducah Site since uranium enrichment operations were ceased in 2013;

- As a result of the new focus on deactivation of the former uranium enrichment facilities, DOE anticipates a substantial increase in the volume of waste and material to be dispositioned during deactivation and other non-CERCLA EM activities [such as, surveillance and maintenance (S&M) activities] at the Paducah Site over the next 12-year period; and

- Addition of several commercial waste treatment and disposal facilities and associated transportation routes not evaluated previously.

This EA does not address waste and material generated as part of an action taken under CERCLA. The evaluation of disposal options for CERCLA waste will be conducted using the CERCLA remedial decision-making process. The Secretarial Policy Statement on the NEPA states: "To facilitate meeting the environmental objectives of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and respond to concerns of regulators, consistent with the procedures of most other Federal agencies, the Department of Energy hereafter will rely on the CERCLA process for review of actions to be taken under CERCLA…." As such, the Policy further states that "CERCLA documents will incorporate NEPA values, such as analysis of cumulative, off-site, ecological, and socioeconomic impacts, to the extent practicable" (DOE 1994). NEPA values for waste and material generated as part of a CERCLA action are addressed in project-specific CERCLA documents. Section 5 of this EA, however, considers CERCLA waste in the evaluation of cumulative impacts.

1.4 NEPA AND RELATED LAWS AND REQUIREMENTS

NEPA [Volume 42 of the United States Code (U.S.C.), Section (§) 4321 *et seq*.] requires that federal agencies consider the potential environmental impacts of their proposed actions and alternatives. In accordance with NEPA, the CEQ, and DOE implementing regulations at 40 *CFR* Parts 1500-1508 and 10 *CFR* Part 1021, respectively, DOE is preparing this EA to assess whether 1) the potential environmental impacts of the Proposed Action and alternatives would be significant to human health and the environment and 2) whether to prepare an environmental impact statement or a FONSI. This EA addresses requirements under NEPA; compliance with National Historic Preservation Act (Public Law 89-665), Endangered Species Act (Public Law 93-205), Clean Air Act (Public Law 88-206), and Clean Water Act (Public Law 92-500), and other applicable laws, DOE procedures and requirements; and subject areas such as land use, floodplains, noise, and public health and safety, as required by 10 *CFR* Part 1021 and 40 *CFR* § 1508.27.

DOE developed a Site Treatment Plan (STP) for MLLW, as required by the Federal Facility Compliance Act of 1992 (Public Law 102-386). The Commonwealth of Kentucky approved the STP, and the Agreed Order was signed on September 10, 1997. The Agreed Order requires that DOE characterize MLLW and RCRA-hazardous waste streams and develop and implement an STP. Annual status updates are provided to Kentucky Department for Environmental Protection.

In 1998, a tri-party agreement, the Federal Facility Agreement (FFA), among DOE, U.S. Environmental Protection Agency (EPA), and Kentucky Energy and Environment Cabinet, was signed. The FFA, as required by Section 120 of CERCLA, provides the legal and regulatory framework for conducting response actions under CERCLA and corrective actions under RCRA at the Paducah Site. In addition, a Toxic Substances Control Act (TSCA) (Public Law 94-469) Compliance Agreement was signed by DOE and EPA on February 20, 1992, modified in 1997, and modified again on May 30, 2017. The Compliance Agreement provides guidance and requirements for removal and disposal of polychlorinated biphenyl (PCB) material.

1.5 SCOPE OF THIS ASSESSMENT

This EA evaluates the potential effects of management and disposition of deactivation and other non-CERCLA waste and materials generated at the Paducah Site from an approximate 12-year period beginning in fiscal year (FY) 2020. Potential effects of waste transportation are evaluated for both highway and rail routes. Also, 12-year waste disposal assumptions result in a baseline disposal time frame. These assumptions do not imply that risks are eliminated after the 12-year period.

The approximate 12-year time period corresponds to the duration during which deactivation activities are anticipated to be performed to prepare for future demolition activities at the site. The amounts and various waste types proposed for off-site treatment and disposal from the Paducah Site are presented in Section 2.1, along with waste transportation options and locations being proposed for off-site waste treatment and disposal.

Paducah Site waste and material volumes anticipated over the approximate 12-year period would equate to less than 3% of the combined capacity of DOE and commercial treatment and disposal facilities identified in this EA (FRNP 2019a); see additional waste capacity discussion in Table 5 under Waste Management. The commercial treatment and disposal facilities that would be used to treat or dispose of the waste are required to operate within the bounds of federal and state requirements, such as the Nuclear Regulatory Commission (NRC) or Agreement State licenses; RCRA permits; air and water permits; and Occupational Safety and Health Administration regulations. The waste planned to be transported is typical of waste being treated and/or disposed of at DOE and commercial waste treatment and/or disposal facilities. Treatment

and/or disposal of the waste at any of the facilities would be conducted in accordance with the facility's operating license, permit, or approval. Because the potential impacts at these disposal facilities were considered as part of the licensing/permitting/approval process for these sites, there would be no additional exposure to the off-site public or on-site workers than expected under these licenses/permits/approvals and those impacts are not detailed in this EA.

The following are other actions at the Paducah Site that are not covered in this EA because they are addressed as part of other existing NEPA documents.

- Construction, operation, and closure of the on-site solid waste landfill (C-746-U) at PGDP (FONSI and DOE/EA-1046; DOE 1995).

- Implementation of the authorized limits[3] process for determining the acceptability of disposing of solid waste containing low-levels of residual radioactivity from the Paducah Site at the C-746-U Landfill (FONSI and DOE/EA-1414; DOE 2002b).

- Transfer of DOE real property at the PGDP site to one or more entities for a use that is different from its current use (FONSI and DOE/EA-1927; DOE 2015).

- Construction and operation of facilities to convert depleted uranium hexafluoride (DUF_6) to depleted uranium (DU) oxide at the Paducah Site (DOE/EIS-0359; DOE 2004).

- Disposition of DU oxide conversion product generated from DOE's inventory of DUF_6 (DOE/EIS-0359-S1/DOE/EIS-0360-S1 and ROD; DOE 2020).

- Various other actions listed in 10 *CFR* Part 1021, Appendix B, and documented in categorical exclusion determinations. The actions include disposal of asbestos waste and PCB waste.

Section 2 of this EA describes the Proposed Action and alternatives. Section 3 describes the affected environment for the action. The potential environmental consequences of the Proposed Action and alternatives are assessed in Section 4 and the potential cumulative impacts on the affected environment when added to past, present, and reasonably foreseeable actions are evaluated in Section 5.

Changes to the affected environment or Proposed Action described in Sections 2 and 3 of this EA may occur during the approximate 12-year period of the Proposed Action. If any such changes occur, DOE will determine the need for additional NEPA documentation pursuant to both the CEQ (40 *CFR* Part 1500) and DOE (10 *CFR* Part 1021) NEPA implementing regulations.

The following sections of this EA provide background of the waste types at the Paducah Site that are evaluated in this EA for management and disposition over the next 12-year period.

[3] Authorized limits are described in DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and are limits established and approved by DOE to permit the release of property from DOE control, consistent with requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE pursuant to the AEA. Waste streams that contain residual radioactive materials below approved authorized limits would not require radiological control under the AEA and would not be considered radioactive waste.

1.5.1 LLW

LLW is radioactive waste that is not high-level radioactive waste; spent nuclear fuel; TRU waste;[4] by-product material [as defined in Section 11e. (2) of the AEA, as amended]; or naturally occurring radioactive material (DOE Guide 435.1-1). In accordance with applicable DOE Orders, radioactive waste will be treated, stored, and, in the case of LLW, disposed of at the site where the waste is generated, if practical, or at another DOE-approved facility. DOE's Deactivation and Remediation (D&R) Contractor at the Paducah Site will request approval annually from DOE, pursuant to the applicable DOE Orders, for the use of non-DOE disposal facilities that provide additional treatment and disposal capabilities and capacities for off-site treatment and disposal of LLW.

1.5.2 MLLW

MLLW is waste subject to RCRA (as amended) and contains a radioactive component subject to the AEA (as amended) that is to be managed in accordance with the requirements of RCRA and DOE. As described previously for LLW, DOE's D&R Contractor at the Paducah Site will request approval annually from DOE pursuant to DOE requirements for the use of non-DOE disposal facilities that provide additional treatment and disposal capabilities and capacities for off-site treatment and disposal of MLLW.

1.5.3 Resource Conservation and Recovery Act Hazardous Waste

RCRA gives EPA the authority to regulate hazardous waste from cradle to grave, including generation, transportation, treatment, storage, and disposal of nonradioactive hazardous and MLLW waste. RCRA also establishes a framework for managing nonhazardous solid wastes. Nonradioactive RCRA hazardous waste generally is any solid, liquid, or contained gaseous material (compressed gas cylinder) that is characteristically hazardous, is a listed hazardous waste, as defined by 40 *CFR* Part 261, and/or is any environmental medium that contains a listed hazardous waste above an approved contained-in level.

Hazardous wastes are a subset of solid wastes that pose substantial or potential threats to public health or the environment and meet any of the criteria identified by 40 *CFR* Parts 260 and 261.

1.5.4 Excess Materials that May Become Solid Waste

DOE has a large volume of excess material, namely 1,2-dichlorotetrafluoroethane (also known as Freon 114 and hereafter referred to as R-114), for which DOE believes there are recycle/reuse options. Should the recycle/reuse options not be viable at the time of disposition of R-114, DOE will be required to manage the R-114 as a solid waste. As a waste, R-114 would not be regulated as a RCRA hazardous waste or TSCA-regulated waste. Because R-114 is an ozone-depleting substance (ODS) regulated by the Clean Air Act (40 *CFR* Part 82), there are restrictions on how R-114 must be dispositioned, and there are a limited number of commercial facilities that have the capability to disposition R-114. A small percentage (approximately 10% or 9,000 ft^3; see Section 2.1) of the R-114 is anticipated to have radioactive contamination levels above DOE authorized limits and require management and disposition as LLW. As described previously for LLW, the DOE D&R Contractor at the Paducah Site will request approval annually

[4] The *Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act* (Public Law 102-579) established the mission of WIPP as disposal of TRU generated by atomic energy defense activities, in accordance with certain limitations set by statute. The WIPP Land Withdrawal Act defines TRU waste as radioactive waste containing more than 100 nanocuries (3,700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the 40 *CFR* Part 191 disposal regulations; or (3) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 *CFR* Part 61.

from DOE, pursuant to DOE Order 435.1 for the use of non-DOE disposal facilities that provide treatment and disposal capabilities of LLW.

1.6 STAKEHOLDER PARTICIPATION

Under 10 *CFR* § 1021.301, DOE must make its NEPA documents available to other federal agencies, states, local governments, American Indian tribes, interested groups, and the general public, in accordance with public participation requirements (40 *CFR* § 1506.6). However, under 10 *CFR* § 1201.340, DOE need not disclose classified, confidential, or other information that DOE otherwise would not disclose pursuant to the Freedom of Information Act (5 U.S.C. § 552). DOE NEPA regulations require that DOE "notify the host state and host tribe of a DOE determination to prepare an EA" [(10 *CFR* § 1021.301(c)]. DOE sent notifications via letters dated March 11, 2020. DOE also "shall provide the…host tribe with an opportunity to review and comment on any DOE EA prior to DOE approval of the EA" [(10 *CFR* § 1021.301(d))]. DOE provided the draft EA to states and Indian tribes, including host states and host tribes, on April 30, 2020. The draft EA includes land within which DOE is proposing this action, including a portion of the preliminary transportation route.

DOE received comments from a number of these state agencies and tribes. The comments, along with DOE's responses to the comments, are provided in Appendix F. DOE considered all comments received and, as noted in Appendix F, made revisions to clarify or supplement information in this EA in response to several of the comments.

The Final EA will be made available on the appropriate DOE website(s), including https://www.energy.gov/pppo/paducah-site/paducah-community-outreach/paducahpublic-documents, and https://www.energy.gov/nepa.

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2. PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action, the No Action Alternative, and other alternatives considered, but dismissed during development of this EA.

2.1 PROPOSED ACTION

DOE proposes to disposition wastes generated from deactivation and other non-CERCLA activities. Waste generated during deactivation of Paducah Site facilities would be conducted under DOE's authority and would not be generated from a CERCLA action. The wastes from the Proposed Action could be generated from any of approximately 480 PGDP buildings and structures at the Paducah Site[5] (Figure 3) (FRNP 2019b). Due to changes in funding levels and priorities, the list of facilities could change periodically during the 12-year period. Therefore, a list of specific facilities is not included in this EA. DOE will evaluate the need for further NEPA analysis based on changes over the life of the proposed action. For the purpose of this EA, forecasted disposition activities are defined as any non-CERCLA actions taken to maintain and/or manage Paducah Site wastes and may include the following: waste generation/handling, waste staging and storage, container movement, packaging/overpackaging/repackaging, equipment and container sorting, physical volume reduction, equipment and waste container decontamination, marking, labeling, inspection, tracking and inventory, characterization, sampling, treatment, loading, and transporting Paducah Site wastes to existing DOE or commercial treatment and disposal locations. The off-site treatment and disposal facilities are in various states, including Arkansas, Florida, Georgia, Nevada, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Utah, and Washington. For analysis, Table 2 presents typical Paducah Site waste types and estimated volumes for transport and disposal over the next approximately 12 years beginning in FY 2020. Mitigation and best management practices may be applied for each disposition activity. Mitigation is discussed further in Section 4.3.

A small percentage of the waste forecasted to be generated may undergo on-site treatment before being shipped off-site for disposal or additional treatment prior to disposal. Section 2.1.2 provides examples of possible on-site treatment methods and processes that may be conducted.

DOE owns and operates facilities used for waste management and disposition activities at the Paducah Site. Currently, these facilities include the C-746-U Landfill (i.e., on-site solid waste landfill); permitted hazardous waste facilities for treatment and storage of MLLW and hazardous waste, and staging and storage facilities for LLW. Facilities used for the staging and storage of LLW are regulated by DOE under the provisions of the AEA. The C-746-U Landfill, which is used for disposal of Paducah Site nonhazardous solid waste, is not addressed further in this EA because it is covered by a separate NEPA EA (see Section 1.3). Facilities for treatment and storage of MLLW and hazardous waste are regulated by the Commonwealth of Kentucky and/or EPA under applicable provisions of RCRA and TSCA, with the radioactive component of MLLW being regulated by DOE under the provisions of the AEA.

The waste to be dispositioned would be generated from activities to deactivate the Paducah Site and from other non-CERCLA activities, including S&M. Anticipated deactivation activities include, but are not limited to removing excess and potentially hazardous and/or radioactive materials, equipment, and systems that no longer are necessary from former process buildings and ancillary facilities; removing small facilities and structures that no longer are necessary; removing radioactive materials from inside process equipment;

[5] As stated in Section 1.3, the facilities used for the conversion of DUF_6 to DU oxide are not included in this EA.

and modifying, including isolating and/or optimizing, the electrical distribution system and other utilities for improved efficiency and cost-effectiveness.

Table 2 lists the waste types and approximate volumes at the Paducah Site that are expected to be generated and disposed of over the next approximately 12 years beginning in FY 2020, along with the location (on-site or off-site) for the proposed treatment and/or disposal. None of the waste volume included in Table 2 is proposed for on-site disposal. The analyses covered in this EA are based on the current projected waste volumes included in Table 2 and a projected 12-year duration for disposition of the waste. The 12-year waste disposition assumption results in a baseline disposition time frame for the risk analysis contained in this evaluation. Depending upon site funding and other factors, the actual duration may vary from the current projection. Changes in the duration of the activity may affect annual impacts, but generally would maintain total impacts.

Table 2. Paducah Site Waste Type Volume Information for 12-Year Period Beginning in Fiscal Year 2020

Waste Type	Approximate Volume[a] to be Generated over 12 Years	Proposed On-site[b] Treatment	Proposed Off-site Treatment	Proposed On-site Disposal	Proposed Off-site Disposal	Approximate Volume[a] to be Shipped
LLW/MLLW—large components[c]	3,813,000	X	X		X	3,813,000
LLW—solid disposal	1,025,000	X	X		X	1,025,000
MLLW—solid disposal	112,000	X	X		X	112,000
MLLW—liquid disposal	67,000	X	X		X	67,000
Nonradioactive RCRA-hazardous	33,000	X	X		X	33,000
Total volume	5,050,000					5,050,000

[a] Approximate volumes are in ft^3.
[b] The assumption is that a small percentage of the total waste volumes for each waste type may undergo some minimal controlled on-site treatment, such as sedimentation, precipitation, oxidation, compaction, macroencapsulation, neutralization, and cementation/solidification.
[c] Approximately 0.2% of the LLW/MLLW-large components waste stream is assumed to be fissile waste. Fissile or fissionable materials, in strict terms, are radionuclides that can sustain a neutron-induced fission chain reaction. As applied to plant operations and for the Paducah Site nuclear criticality safety program, fissile material is (1) material enriched to greater than or equal to 1.0 weight% uranium-235 (U-235) isotope and in quantities greater than or equal to 15 grams of U-235, or (2) material containing other fissionable radionuclides that can sustain a chain reaction in quantities greater than or equal to 1.6% of their maximum subcritical mass.

TRU waste is not anticipated to be generated under the Proposed Action, which is why it is not specifically listed in Table 2 and analyzed in the transportation analyses later in this EA. However, the potential does exist for TRU waste to be generated in extremely small volumes that would not substantively affect the transportation risk calculations in this EA, worker and public safety and health, or capacity impacts at WIPP. Any future TRU waste or mixed TRU waste generated at the Paducah Site will be managed in accordance with the STP and/or existing protocols for contact-handled TRU waste destined for WIPP (FRNP 2018a; DOE 1998b; DOE 2018b; NMED 2019). DOE will determine at that time whether any additional analysis or NEPA documentation is necessary.

In addition, the Paducah Site also has approximately 8.5 million pounds (lb) (approximately 93,000 ft^3) of excess R-114 that may require off-site disposition. If R-114 reuse or recycling opportunities cannot be identified, then the R-114 will be disposed of by shipping the material to off-site commercial treatment facilities for destruction. As a result, the excess R-114 is being evaluated in this EA for disposition. Most R-114 on-site is not considered radiologically contaminated (that is, the R-114 is expected to be below DOE authorized release limits). Approximately 10% of the total is estimated to be above DOE authorized release limits and may be dispositioned as LLW; this volume of R-114 estimated to be dispositioned as LLW is approximately 850,000 lb (approximately 9,000 ft^3). The R-114 potential waste volumes are listed in Table 3. If the R-114 cannot be recycled or reused, it would be considered a solid waste. R-114 is not regulated as a RCRA hazardous or TSCA-regulated waste, but is an ODS regulated by the Clean Air Act (40 *CFR* Part 82).

Table 3. R-114 Potential Waste Volume Information for 12-Year Period Beginning in Fiscal Year 2020

Waste Type	Approximate Volume[a] to be Generated over 12 Years	Proposed On-site Treatment	Proposed Off-site Treatment	Proposed On-site Disposal	Proposed Off-site Disposal	Approximate Volume[a] to be Shipped
R-114 that is expected to be below DOE authorized release limits	84,000		X		X	84,000
R-114 that is expected to be above DOE authorized release limits	9,000		X		X	9,000
Total Volume	93,000					93,000

[a] Approximate volumes are in ft^3.

The Paducah Site may have small volumes of similar types of solid waste (that is, waste that is not radioactively contaminated and not classified as RCRA hazardous or TSCA) that require special handling (such as, other refrigerants) that will be addressed pursuant to applicable regulatory requirements. The potential volumes of other refrigerants at the Paducah Site are extremely small (less than 0.05%) compared to the R-114 volume and are considered to be part of the excess R-114 for purposes of this evaluation. Other solid waste, if not covered by other NEPA or CERCLA documents at the Paducah Site, will be evaluated in accordance with NEPA outside the scope of this EA.

Table 4 lists the off-site DOE and commercial facilities being considered for treatment and/or disposal of LLW, MLLW, and nonradioactive RCRA wastes, and for destruction of the R-114 wastes (if necessary) from the Paducah Site under this EA. The table also lists the proposed types of waste accepted at and proposed modes of transport from the Paducah Site to each facility. The proposed on-site and off-site treatment methods and operations, waste transport options, and potential waste disposal facilities for waste volumes in Table 2 are discussed in Sections 2.1.2 through 2.1.4.

DOE and its D&R Contractor will use reasonable actions to minimize waste generation.

Table 4. Potential Treatment and Disposal Facilities for Waste Types from the Paducah Site and Transport Modes from the Paducah Site to Each Facility

Treatment and/or Disposal Facility/Location	Accepted Paducah Site Waste Type	Transport Modes	Site Activities
Energy*Solutions*, Clive, UT	LLW, MLLW	Highway, rail	Treatment and Disposal[a]
Energy*Solutions*, Oak Ridge, TN	LLW, MLLW	Highway, rail	Treatment[b]
Perma-Fix Northwest, Richland, WA	LLW, MLLW	Highway, rail	Treatment[b]
Perma-Fix of Florida, Gainesville, FL	LLW, MLLW	Highway	Treatment[b]
Perma-Fix Diversified Scientific Services, Inc., Kingston, TN	LLW, MLLW, R-114	Highway, rail	Treatment[b]
Waste Control Specialists LLC (WCS), Andrews, TX	LLW, MLLW	Highway, rail	Treatment and Disposal
NNSS, Mercury, NV	LLW, MLLW	Highway	Disposal[c]
Clean Harbors, El Dorado, AR	Nonradioactive RCRA-hazardous waste; R-114	Highway, rail	Treatment and Disposal
Clean Harbors, La Porte, TX	Nonradioactive RCRA-hazardous waste	Highway	Treatment[b]
Clean Harbors Deer Park, La Porte, TX	Nonradioactive RCRA-hazardous waste	Highway	Treatment and Disposal

Table 4. Potential Treatment and Disposal Sites for Waste Types from the Paducah Site and Transport Modes from the Paducah Site to Each Facility (Continued)

Treatment and/or Disposal Facility/Location	Accepted Paducah Site Waste Type	Transport Modes	Site Activities
Clean Harbors, Reidsville, NC	Nonradioactive RCRA-hazardous waste	Highway	Treatment and Disposal
Clean Harbors, Cincinnati (Spring Grove), OH	Nonradioactive RCRA-hazardous waste	Highway	Treatment and Disposal
Evoqua Water Technologies, Darlington, PA	Nonradioactive RCRA-hazardous waste	Highway	Treatment and Disposal
A-Gas, Bowling Green, OH	R-114	Highway, rail	Treatment and Disposal
Heritage Thermal Services, East Liverpool, OH	R-114	Highway, rail	Treatment and Disposal
Chill-Tek, Las Vegas, NV	R-114	Highway, rail	Treatment and Disposal
Hudson Technologies, Atlanta, GA	R-114	Highway, rail	Treatment and Disposal
Veolia Environmental Services, Port Arthur, TX	R-114	Highway, rail	Treatment and Disposal
Clean Harbors Aragonite Incineration Facility	R-114	Highway, rail	Treatment and Disposal

[a] Energy*Solutions* can dispose of only Class A LLW/MLLW.
[b] Treatment of the waste would occur at the identified facility, followed by the treatment facility that has taken title to the waste, shipping the waste to an appropriately licensed, permitted, and/or authorized disposal facility.
[c] Treatment of the waste would be completed, if needed, at other permitted facility before disposal. MLLW meeting LDR treatment standards may be disposed of at NNSS.

2.1.1 Storage and Staging

Waste management storage and staging facilities are used not only to store and stage waste containers, but also to sample, sort, segregate, survey, and repackage waste. Under the Proposed Action, waste would be stored and staged at the Paducah Site until the waste is treated on-site or transported off-site for treatment and/or disposal. Existing facilities and waste generation locations would be used for waste staging and storage.

Following are the primary waste storage and staging facilities and the wastes stored or staged at the Paducah Site (FRNP 2018a).[6] These facilities are shown in Figure 3.

- **C-733:** This RCRA-permitted facility is used to store LLW, MLLW, PCB/radioactive waste, hazardous waste, and PCB waste. This facility is the only on-site facility authorized to store ignitable hazardous waste with a flash point less than 100 degrees Fahrenheit (°F).

- **C-746-H3:** This facility is used to temporarily stage LLW, recyclable scrap metal, PCB waste, and solid waste capable of meeting the waste acceptance criteria for disposal at the C-746-U Landfill. This facility is used to facilitate sorting and segregation activities.

[6] Although PCB waste is stored or staged in some of the listed facilities, PCB waste is not evaluated in this EA because it is addressed by Categorical Exclusion 451.1a-054.

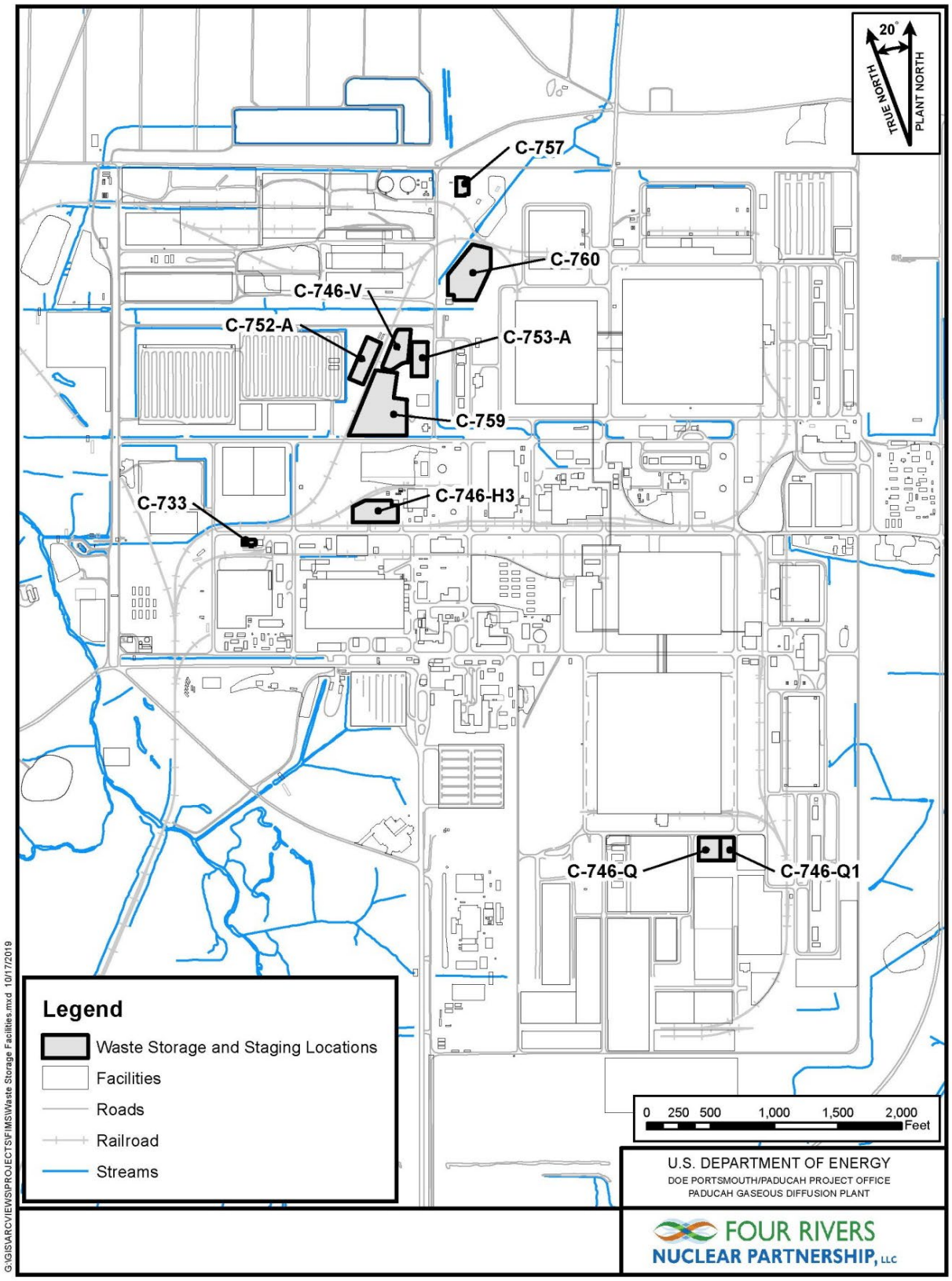

Figure 3. Waste Storage and Staging Locations

- **C-746-Q:** This RCRA-permitted facility can be used to store LLW, TRU waste, waste greater than Class C, classified waste, MLLW, PCB/radioactive waste, hazardous waste, fissile material, and PCB waste. Waste in this facility may be treated with absorbents to remove free liquids, repackaged (including sorting/consolidating to facilitate shipment), overpacked, or analyzed using a nondestructive assay. This facility also is permitted to treat, sample, and repackage certain Paducah Site RCRA waste.

- **C-746-Q1:** This facility is used to store empty containers, and it can be used to store nonhazardous fissile material or LLW.

- **C-746-V:** This outside gravel pad is a waste-staging area. LLW and solid waste can be stored here temporarily.

- **C-752-A:** This RCRA-permitted facility is used to store LLW, MLLW, PCB/radioactive waste, wastewater, hazardous waste, and PCB waste. Hazardous waste treatment, sampling, and repacking also occur at this facility. The facility serves as the pollution prevention waste minimization consolidation center. This facility may store ignitable waste with a flash point greater than 100°F. Wastewater treatment activities occur in this facility.

- **C-753-A:** This facility is used to store LLW, PCB/radioactive waste, and PCB waste. Spare equipment and empty containers are stored in this facility.

- **C-757:** This facility is used to temporarily stage and accumulate LLW, MLLW, and hazardous waste. This facility houses a RCRA 90-day accumulation area and temporary PCB waste storage area. This facility is used to facilitate sorting, sampling, and segregation activities.

- **C-759:** This gravel pad is a staging area for waste and processing of LLW to prepare for disposal.

- **C-760:** This gravel pad is primarily used for sanitary/industrial waste identified for disposal in the on-site C-746-U landfill, but also contains a CERCLA accumulation area.

Additional waste storage capacity may need to be designated and/or permitted. In addition, DOE will maximize the use of RCRA satellite accumulation areas and 90-day storage areas in lieu of or prior to transferring waste to the waste storage and staging facilities.

The excess R-114 at the Paducah Site is stored in International Organization for Standardization (ISO) containers, railcars, and various process equipment. The ISO containers and railcars are not located within any facility. The ISO containers are stored outdoors on trailers in a gravel storage area. The railcars are stored outdoors on railroad spurs. The R-114 that remains in the process equipment is located within the C-333, C-335, and C-337 facilities.

2.1.2 On-Site Treatment

Most waste evaluated in this EA would not undergo on-site treatment at the Paducah Site because the waste is comprised of large components that would not be practical to down-size or treat on-site because of the required construction and implementation of a downsizing/treatment operation. Approximately 24% (or 1,237,000 ft^3) of the total waste volume of 5,050,000 ft^3 is not comprised of large components and would be considered for on-site treatment. Storage facilities C-733, C-746-H3, C-746-Q, C-752-A, and C-753-A are the primary facilities proposed for processing on-site waste that will need to be treated (FRNP 2018a). On-site treatment technologies within the RCRA-permitted facilities (that is, C-733, C-746-Q, and C-752-A) at the Paducah Site are limited by the current site RCRA hazardous waste management facility permit. RCRA-permitted on-site treatment technologies include precipitation,

oxidation, compaction (that is, volume reduction), macroencapsulation, decanting, absorption, neutralization, and stabilization in containers. Additional limited treatment activities, such as elementary neutralization or other treatment approved by the Kentucky Division of Waste Management (KDWM) to be performed in generator areas, may occur outside of the RCRA-permitted facilities. The technologies discussed in Sections 2.1.2.1 through 2.1.2.4 are the RCRA-permitted treatment technologies that would apply to the waste types associated with the Proposed Action.

Wastes acceptable for neutralization, volume reduction, stabilization, or a combination of these treatments would be transferred to either the C-746-Q or the C-752-A facilities. Fluorescent bulbs and miscellaneous lamps would be treated on-site through compaction and would be treated at the C-746-Q facility or other treatment facility approved by KDWM. Decanting and absorbing free liquids would occur at any of the permitted storage facilities (that is, C-746-Q, C-752-A, or C-733). Treatment by compaction, macroencapsulation, or combination of the two treatment methods would occur only at the permitted facilities in accordance with applicable conditions and requirements of the RCRA hazardous waste management facility permit (KY8-890-008-982); this permit and waste acceptance criteria (FRNP 2018b) specify the waste streams and treatment methods acceptable, respectively, at the permitted facilities.

The excess R-114 would not be treated on-site.

2.1.2.1 Neutralization

Neutralization reduces the acidity or alkalinity of hazardous wastes in a waste stream to a more neutral condition. The process consists of blending acids and bases to adjust the pH (a measure of acidity or alkalinity) to yield a neutral solution of salt and water. Alkaline wastes often are mixed with acid wastes, thereby neutralizing two waste streams at the same time. Neutralized waste is safer to store, transport, and dispose of than acidic or alkaline waste.

2.1.2.2 Stabilization and macroencapsulation

Stabilization waste treatment involves mixing specialized additives or reagents with hazardous waste materials to reduce, by physical or chemical means, the solubility or mobility of contaminants in the surrounding environmental matrix. Macroencapsulation waste treatment involves application of surface coating materials such as polymeric organics (e.g., resins and plastics) or use of a jacket of inert inorganic materials to reduce surface exposure to potential leaching media.

2.1.2.3 Compaction and volume reduction

To reduce the volume of waste and to optimize the total costs associated with on-site waste management and ultimate disposal, compaction or volume reduction may be employed. Volume reduction may be accomplished by compacting, disassembling, and cutting or shearing system components and demolishing debris to practical dimensions for container loading (based on equipment capabilities and cost-effectiveness of size-reduction efforts). Compaction and volume reduction activities that may generate fugitive emissions would include plans for the control of emissions.

2.1.2.4 Sorption

Absorption and adsorption are sorption treatment processes that may be used to treat waste. Absorption will be used to eliminate free liquids in sludges, semisolids, or waste liquids that are decanted. Care will be taken to ensure waste compatibility with the container, absorption materials, pumps, or other devices used in the decanting process. Absorption is the process whereby one substance enters (or is absorbed) into

another substance. Adsorption is the process whereby molecules adhere to a surface with which they come into contact because of forces of attraction at the surface.

2.1.3 Off-Site Treatment and Disposal

DOE's Proposed Action for off-site treatment varies by waste type. The waste characteristics govern where and how each waste type may be treated. The proposed treatment scenario for each waste type is presented in the following subsections.

2.1.3.1 LLW/MLLW—large components

In accordance with applicable DOE orders, LLW/MLLW will be treated, stored, and disposed of at the site where the waste is generated, if practical; at another DOE facility; or a non-DOE facility if DOE capabilities are not practical or cost-effective. Most of the approximate 3,813,000 ft^3 of LLW/MLLW large components included in Table 2 would not require treatment prior to disposal. If treatment prior to disposal is required, the waste normally would be treated off-site because off-site treatment is consistent with DOE's ROD for LLW and MLLW (DOE 2000). Table 4 identifies the proposed off-site treatment and disposal facilities for LLW/MLLW.

2.1.3.2 LLW—solid disposal

In accordance with applicable DOE Orders, LLW will be treated, stored, and disposed of at the site where the waste is generated, if practical; at another DOE facility; or a non-DOE facility, if DOE capabilities are not practical or cost-effective. Most of the approximate 1,025,000 ft^3 of solid LLW included in Table 2 would not require treatment prior to disposal. If treatment prior to disposal is required, the waste normally would be treated off-site because off-site treatment is consistent with DOE's ROD for LLW (DOE 2000). Table 4 identifies the proposed off-site treatment and disposal facilities for LLW. A small volume of these wastes may be treated on-site, as described in Section 2.1.2, prior to shipment off-site for disposal, if determined to be cost-effective and safe to do so.

2.1.3.3 MLLW—solid and liquid

The approximate 179,000 ft^3 of solid and liquid MLLW included in this Proposed Action represents a heterogeneous grouping of wastes. A small portion of the waste could contain PCBs, metals, and/or organics. MLLW must meet applicable LDR treatment standards prior to disposal. Most of the MLLW would be treated and disposed of at various off-site licensed and/or permitted facilities identified in Table 4 because off-site treatment and disposal is more cost-effective and practical and also is consistent with DOE's ROD for LLW and MLLW (DOE 2000). A small volume of the waste amenable to the treatment technologies available at the Paducah Site may be treated on-site as described in Section 2.1.2 prior to shipment off-site for disposal.

2.1.3.4 Nonradioactive Resource Conservation and Recovery Act hazardous waste

RCRA-hazardous wastes must meet applicable LDR treatment standards prior to disposal. A small portion of the approximate 33,000 ft^3 of nonradioactive RCRA-hazardous waste may be treated on-site, but typically these wastes would be treated at locations designated in Table 4. These wastes would be treated off-site because off-site treatment is consistent with DOE's ROD for non-wastewater hazardous waste (DOE 1998a).

2.1.3.5 Excess materials that may become solid waste

Approximately 9,000 ft^3 of the 93,000 ft^3 of excess R-114 that is estimated to be greater than DOE authorized release limits may be disposed of as LLW; the decision and approach for disposition of the R-114 have not been finalized. The proposed R-114 disposition actions are analyzed as independent activities in this EA. The off-site facilities proposed for destruction and disposition of the 93,000 ft^3 of R-114 are included in Table 4.

2.1.4 Waste Transportation

A total of 5,050,000 ft^3 of LLW, MLLW, and non-radioactive RCRA hazardous waste, and 93,000 ft^3 of R-114 is proposed to be transported off-site for treatment and disposal. This waste would be transported to locations designated in Table 4 by one of two transportation modes (FRNP 2018a): (1) over the road trucking (highway) or (2) rail. Decisions regarding selection of transportation modes to determine the most advantageous mode would involve the destination location, respective waste acceptance criteria and logistics of prospective receiving facilities, technical requirements for material handling, and overall cost comparisons. Truck and rail routes to potential DOE-approved disposal sites are discussed further and illustrated in Section 3.2.2.1.

2.1.5 Waste Disposition Supporting Activities

The on-site waste disposition supporting activities would include, but are not limited to, the following:

- On-site waste movement
- Packaging, overpackaging, and repackaging
- Sorting
- Volume reduction
- Waste container decontamination
- Inspection
- Inventory
- Marking/labeling
- Characterization/sampling
- Facility modifications or upgrades

The waste disposition supporting activities would be performed in accordance with applicable DOE Orders, federal and state regulations, and approved D&R Contractor or subcontractor procedures. These procedures would be utilized to ensure activities are performed in a safe, compliant, and accountable manner.

2.2 NO ACTION ALTERNATIVE

In the No Action Alternative, DOE would not perform off-site treatment and disposal activities and would continue only on-site waste storage and on-site disposal[7] activities. No new projects that would generate LLW, MLLW, or RCRA hazardous waste would be undertaken (that is, deactivation of facilities to prepare for decommissioning and disposition of excess R-114). Only S&M of the Paducah Site facilities would be conducted. The S&M waste would be stored on-site. Any S&M waste that would need to be dispositioned

[7] On-site disposal in C-746-U Landfill of nonhazardous, nonradioactive solid wastes below DOE authorized release limits would continue in accordance with DOE/EA-1414 (DOE 2002b). This EA (DOE/EA-2116) does not address on-site disposal covered under the separate EA (DOE 2002b).

off-site compliantly would have to undergo further NEPA review before disposition. Because S&M would be ongoing into the foreseeable future with no diminishing radiation risk from waste being shipped off-site, a 100-year accrual period was used to assess impacts to the workers under the No Action Alternative. The 3,813,000 ft^3 of LLW/MLLW large components outlined in Table 2 and the 93,000 ft^3 of excess R-114 discussed under the Proposed Action would not be generated, and the only wastes that would be generated would result from routine S&M activities (total of 1,237,000 ft^3). Agreements such as the STP and FFA discussed in Section 1.4 would need to be renegotiated to allow for DOE compliance. The No Action Alternative also would not meet the Portsmouth/Paducah Project Office mission to accelerate cleanup, eliminating potential environmental threats, reducing the DOE footprint, and reducing life-cycle cost. CERCLA activities would continue via a separate pathway under the CERCLA process regardless of the alternative selected under this EA.

2.2.1 Storage and Staging

Waste storage and staging would not differ from the Proposed Action, except for the length of time wastes would be stored or staged (100 years), as described in Section 2.2. Wastes generated from S&M would be staged and stored on-site in the same locations identified under the Proposed Action in Section 2.1.1. Also included under the No Action Alternative would be waste storage facility maintenance as needed.

Existing permitted storage capacity for MLLW and nonradioactive hazardous waste could be exhausted by FY 2027. Existing on-site facilities would need to be converted to and permitted for hazardous waste storage before the existing permitted storage capacity would be exhausted, which typically is a lengthy regulatory process that would need to be initiated several years prior to the anticipated date that the capacities would be exceeded. Existing storage capacity for LLW also could be exhausted before the end of the 12-year period analyzed, but existing on-site facilities or portions thereof could more easily be converted to LLW waste storage facilities. The process to convert the existing on-site facilities to LLW storage facilities could be performed under DOE's authority in a much shorter time period than required for a permitted hazardous waste storage facility.

2.2.2 On-Site Treatment

On-site treatment would be performed only on wastes that require some type of stabilization prior to long-term storage to render the waste safer for long-term storage. On-site treatment technologies discussed in Section 2.1.2 that would be utilized as needed on an individual basis include neutralization or macroencapsulation. Any on-site waste treatment requiring indoor processing or treatment would occur in one of the appropriate waste storage locations described under the Proposed Action in Section 2.1.1. The on-site treatment technologies are limited by the RCRA hazardous waste management facility permit or as approved by KDWM.

2.2.3 Off-Site Treatment and Disposal

Under the No Action Alternative, no waste would be transported off-site for treatment or disposal.

2.2.4 Waste Transport

Under the No Action Alternative, no waste would be transported off-site for treatment or disposal.

2.2.5 Waste Disposition Supporting Activities

Waste disposition supporting activities under the No Action Alternative are the same as for the Proposed Action, as discussed in Section 2.1.5.

2.3 ALTERNATIVES CONSIDERED BUT DISMISSED

The following alternatives were considered, but dismissed from further analysis in this EA. As is the case for the Proposed Action and No Action Alternative, CERCLA activities and ongoing CERCLA waste management would continue under the CERCLA process and are not addressed in this EA. Additionally, any activities that are covered under other existing NEPA evaluations also would continue (see Section 1.3).

2.3.1 On-Site Treatment of All Wastes

DOE considered the alternative to treat all wastes generated under this EA on-site, but dismissed this alternative because some technologies, such as vacuum thermal desorption and incineration and boilers/industrial furnaces, needed for waste treatment currently do not exist at the Paducah Site. Building new facilities to treat all waste types would require major capital expenditures and not be cost effective; would be contrary to DOE decision documents (see Table 1); and finally, could require modifications to regulatory agreements discussed in Section 1.4. In addition, some treated wastes still would require disposal following treatment to meet regulatory and/or DOE requirements for which disposal capacity is currently only available off-site. On-site treatment of a small amount of waste is included under the Proposed Action and would be accomplished in accordance with the site's RCRA hazardous waste management facility permit, regulatory agreements, and RCRA-permitted facilities' regulatory requirements.

2.3.2 Off-Site Treatment of All Wastes

DOE considered the alternative to treat all wastes generated under this EA off-site, but dismissed this alternative because some on-site treatment activities are necessary to meet U.S. Department of Transportation (DOT) regulations for transportation of the waste. This alternative also would be contrary to DOE decision documents (see Table 1). Off-site treatment of the generated waste, as appropriate, followed by off-site disposal is included under the Proposed Action.

2.3.3 On-Site Disposal of All Wastes

DOE considered the alternative to dispose of all wastes generated under this EA on-site, but dismissed this alternative. Under this alternative, no off-site disposal of waste would occur. Treatment of some waste would be required prior to disposal. Because the required treatment technologies are not available on-site, such as vacuum thermal desorption and incineration and boilers/industrial furnaces, this waste would require off-site treatment prior to on-site disposal or construction/installation of the required treatment technologies on-site.

In addition to the lack of treatment technologies, this alternative also would result in the need for a new landfill built for this purpose. The current on-site landfill is permitted only for nonhazardous solid waste that is within DOE authorized radioactive release limits, and it is not permitted for MLLW or RCRA wastes (FRNP 2018b). Waste storage capacity at the Paducah Site is not available for the large volume of waste that would be generated prior to the availability of a new on-site landfill. The existing on-site permitted waste storage capacity would be exceeded approximately half-way through the time period analyzed in this EA (by FY 2027), and the existing on-site non-permitted waste storage capacity would be exceeded within the first few years. Lack of on-site disposal and storage capacity for the large volume of waste would result in schedule delays and extension of the time period for completion of planned deactivation activities.

In addition, some wastes would have to be shipped off-site for treatment prior to on-site disposal because the required treatment technology is not available on-site. These wastes would then be returned to the Paducah Site for disposal. The lack of storage facilities and treatment technologies, combined with the

impacts from constructing a new on-site landfill, are reasons for dismissal of this alternative. In addition, this alternative also would be contrary to DOE decision documents (see Table 1).

2.3.4 On-Site Storage of All Wastes

DOE considered the alternative to store all wastes generated under this EA on-site, but dismissed this alternative. Under this alternative, no disposal of the generated wastes would occur either on-site or off-site. On-site treatment would be performed only on wastes that require stabilization prior to storage and then in accordance with the RCRA hazardous waste management facility permit or on-site treatment approval from the KDWM; no off-site treatment would occur.

Waste storage capacity at the Paducah Site is not available for the large volume of waste that would be generated over the analyzed 12-year time period. The existing on-site, permitted, waste storage capacity would be exceeded approximately half-way through the time period (by FY 2027), and the existing on-site non-permitted waste storage capacity would be exceeded within the first few years. New waste storage facilities would need to be constructed or existing site facilities would need to be converted and upgraded. Building new waste storage facilities for the storage of waste from deactivation and other non-CERCLA activities would require major capital expenditures, is not cost-effective, and is not included in DOE's current mission of deactivation and remediation at the Paducah Site. In addition, insufficient space is available in existing site facilities for conversion and upgrading for use as waste storage facilities to store all of the generated waste volumes, particularly the large process components. It also would be ineffective to remove the large components from one facility to store them in another facility on-site. Lack of storage capacity for the large volume of waste would result in schedule delays and extension of the time period for completion of planned deactivation activities. In addition, this alternative could require modifications to the regulatory agreements described in Section 1.5.

3. AFFECTED ENVIRONMENT

In accordance with CEQ NEPA regulations (40 *CFR* Parts 1500 through 1508) and DOE NEPA implementing procedures (10 *CFR* Part 1021), this section describes the affected or existing environment that potentially could be affected by the Proposed Action. The affected or existing environment is the physical and natural environment of the Paducah Site, area surrounding the Paducah Site, and various transportation routes to treatment and/or disposal locations that are the result of past, present, and reasonably foreseeable future actions. For some impact areas, the on-site impacts identified may include some nearby but off-site areas.

The affected environment provides the context for understanding the potential direct, indirect, and cumulative environmental effects of each alternative described in Section 2, "Proposed Action and Alternatives." The affected environment provides the baseline from which to compare impacts from the Proposed Action and No Action Alternative (described in Section 4). In addition, the affected environment provides the baseline for analyzing the impacts of reasonably foreseeable future actions and the impacts of the Proposed Action and No Action Alternative for the cumulative impacts analysis (described in Section 5).

Section 3.1 presents an assessment of environmental resource areas and identifies those subject areas that were considered and dismissed from detailed analysis. Section 3.2 identifies the subject areas of the affected environment that are analyzed in detail.

3.1 SUBJECT AREAS CONSIDERED AND DISMISSED FROM DETAILED ANALYSIS

Consistent with the CEQ (40 *CFR* Parts 1500–1508) and DOE NEPA implementing regulations and guidance, the analysis in this EA focuses on subject areas that are relevant to the Proposed Action and alternative. As stated in the CEQ regulations:

> Impacts shall be discussed in proportion to their significance. There shall be only brief discussion of other than significant issues. As in a finding of no significant impact, there should be only enough discussion to show why more study is not warranted [40 *CFR* § 1502.2(b)].

DOE conducted an initial screening analysis of impacts to determine the need for a detailed analysis. Where appropriate, DOE has conducted impact analysis specific to the proposed action to support a decision regarding the environmental impacts of the Proposed Action. Table 5 describes the subject areas that have been dismissed from detailed analysis in this EA. For each subject area discussed in the table, the activities evaluated include the following: (1) on-site waste storage, staging, treatment, transportation, and supporting activities; and (2) off-site waste transportation, which is applicable only to the Proposed Action because there would be no waste shipped off-site under the No Action Alternative.

Table 5. Subject Areas Dismissed from Detailed Analysis

Subject Area	Activities Evaluated	Evaluation
Land Use	On-site waste storage, staging, treatment, transportation, and supporting activities	DOE property at the Paducah Site is situated on approximately 3,556 acres, which includes a heavily developed industrial core area surrounded by 1,986 acres of the undeveloped land licensed to the Commonwealth of Kentucky as part of West Kentucky Wildlife Management Area (WKWMA) (Figure 2). Public activities, including hunting, horseback riding, hiking, and biking, are allowed on the land licensed to Kentucky that contains access roads and multiple rights-of-way for electrical transmission lines, but otherwise is a mixture of woodlands and meadows (FRNP 2020). The industrial area within the site, also referred to as PGDP, had been used primarily to produce enriched uranium fuel using a gaseous diffusion process, and the area includes five, major former process buildings with many support facilities, utility infrastructure, roads, grassy areas, and parking lots. No physical changes or expansion of the existing site or construction of new on-site facilities is anticipated. The land use designation for the Paducah Site, therefore, would not change from the existing land use designation under either of the alternatives.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. The land use designation for areas potentially affected by off-site waste transportation, therefore, would not change from the existing land use designation.
Geology and Geologic Resources	On-site waste storage, staging, treatment, transportation, and supporting activities	No substantial geological resources such as mineral deposits have been identified at the Paducah Site. No expansion of the existing site or construction of new on-site facilities is anticipated under either of the alternatives; therefore, there would be no effect to the existing geology or geologic resources at the Paducah Site under either of the alternatives. Potential seismic activity is analyzed in the discussion of potential accidents.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes; therefore, there would be no effect to the existing geology or geologic resources along the transportation routes.

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Soils and Prime Farmland	On-site waste storage, staging, treatment, transportation, and supporting activities	Soils at the Paducah Site have become disturbed as a result of construction and maintenance activities occurring at the site since the early 1950s. Although soils on the Paducah Site include some soil types that are representative of prime farmland; prime farmland, as defined by the U.S. Department of Agriculture's Natural Resources Conservation Service, does not include "urban built-up land or water" (7 *CFR* Parts 657 and 658). No physical changes, expansion of the existing site, or construction of new on-site facilities is anticipated under either of the alternatives. Accidents, such as a waste spill or release, would have negligible impact on soils on-site or off-site because of in-place measures such as dikes and spill controls, including nonporous secondary containment, and immediate cleanup measures that would be implemented in accordance with the regulatory licenses/permits/approvals and DOE and D&R Contractor procedures. Negligible impact to soils or prime farmland at the Paducah Site or nearby is anticipated under either of the alternatives.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Accidents, such as a waste spill or release during transport, likely would have negligible impact on soils and prime farmland off-site because near-term emergency response actions would be implemented in accordance with waste transportation regulations.
Surface Water	On-site waste storage, staging, treatment, transportation, and supporting activities	The Paducah Site is located on a local drainage divide; surface flow is to the east and northeast toward Little Bayou Creek, which passes along the eastern boundary of the Paducah Site, and to the west and northwest toward Bayou Creek, which passes along the western boundary of the site (Figure 2). The confluence of the creeks is approximately 3 miles north of the site. After the confluence of these two creeks, Bayou Creek flows for 0.2 mile, where confluence occurs with the Ohio River (EPA 2017). Bayou and Little Bayou Creeks receive effluent discharges from the Paducah Site, including process effluent, storm-water discharge, and sanitary wastewater (only Bayou Creek receives sanitary wastewater)

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Surface Water (Continued)	On-site waste storage, staging, treatment, transportation, and supporting activities (Continued)	under Kentucky Pollutant Discharge Elimination System Permit KY0004049. Bayou and Little Bayou Creeks were included on Kentucky's 303(d) Listed Waters for Reporting Year 2016 for exceedances of the water quality standards for beta particles and photon emitters, copper, gross alpha, lead, and mercury (only Bayou Creek was listed for mercury) (KEEC 2016). On-site waste storage, staging, treatment, transportation, and supporting activities would not result in release of waste constituents to surface water at concentrations exceeding water quality standards or other regulatory requirements. These activities would be performed in accordance with regulatory licenses/permits/approvals and applicable DOE Orders and D&R Contractor procedures in existing facilities that are equipped with spill controls, such as nonporous floors, dikes, and/or secondary containment. In addition, immediate cleanup measures would be implemented in accordance with the regulatory licenses/permits/approvals and applicable DOE Orders and D&R Contractor procedures. As a result, accidental spills or releases would be expected to be minor (such as a small-volume release) and would have negligible impact on surface water.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing, licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Accidents, such as a waste spill or release during transport, likely would have negligible impact on surface water off-site because of near-term emergency response actions that would be implemented in accordance with waste transportation regulations.
Groundwater	On-site waste storage, staging, treatment, transportation, and supporting activities	Groundwater in McCracken County usually is between 30 and 200-ft deep and generally is less than 100-ft deep. It is common to observe multiple zones of production throughout McCracken County, and the water quality within the aquifers is generally good (KGS 1997). At the Paducah Site, the depth to the water table typically is 40 ft or less, and in the western half of the industrial area, the water table is generally less than 20-ft deep (DOE 1997b). Currently, there are several areas of groundwater contamination at the Paducah Site that are known to contain trichloroethene (TCE) and/or technetium-99 (Tc-99). Known or potential sources of TCE and Tc-99 include former test areas, spills, leaks, buried waste, and leachate derived from contaminated scrap metal previously stored on-site. Investigations of source areas of TCE are ongoing at the Paducah Site. These areas are monitored through groundwater

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Groundwater (Continued)	On-site waste storage, staging, treatment, transportation, and supporting activities (Continued)	monitoring wells and managed under RCRA and/or CERCLA regulations. On-site waste storage, staging, treatment, transportation, and supporting activities would not be expected to have any additional effect on the Paducah Site groundwater under either of the alternatives. These activities would be performed in accordance with regulatory licenses/permits/approvals and DOE and D&R Contractor procedures in existing facilities that are equipped with spill controls, such as nonporous floors, dikes, and/or secondary containment. In addition, immediate cleanup measures would be implemented in accordance with the regulatory licenses/permits/approvals and DOE and D&R Contractor procedures. As a result, accidental spills or releases would be expected to be minor (such as a small volume release) and would have negligible impact on groundwater.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Accidents, such as a waste spill or release during transport, likely would have negligible impact on groundwater off-site because of near-term emergency response actions that would be implemented in accordance with waste transportation regulations.
Floodplains and Wetlands	On-site waste storage, staging, treatment, transportation, and supporting activities	Floodplains along Bayou and Little Bayou Creeks do not extend into the industrial core of the site where the on-site activities evaluated in this EA would be conducted (FEMA 2011). No wetlands are located at or in the immediate vicinity of the facilities used for on-site storage, staging, treatment, transportation, and supporting activities (COE 1994; NWI 2019). As a result, no impacts to floodplains or wetlands from on-site activities are anticipated under either of the alternatives.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Accidents, such as a waste spill or release during transport, likely would have negligible impact on floodplains or wetlands off-site because near-term emergency response actions that would be implemented in accordance with waste transportation regulations.

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Ecological Resources	On-site waste storage, staging, treatment, transportation, and supporting activities	Appendix C details the threatened and endangered plant and animal species potentially occurring at or near the Paducah Site. These species are more likely to be found within the vegetative communities at the Site. The on-site waste storage, staging, treatment, transportation, and supporting activities sites are located in the heavily developed industrial core of the Paducah Site, which consists primarily of buildings, structures, and paved or gravel areas with limited grass covered areas. Any spills or releases from the on-site activities would be expected to be minor (such as a small-volume release) and would be contained and/or mitigated by various best management practices. As a result, negligible impact would be anticipated on ecological resources at the Paducah Site under either of the alternatives.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Accidents, such as a waste spill or release during transport, likely would have negligible impact on ecological resources off-site because of near-term emergency response actions that would be implemented in accordance with waste transportation regulations.
Noise	On-site waste storage, staging, treatment, transportation, and supporting activities	Currently, there are no local ordinances concerning noise regulation at the Paducah Site or at any nearby facilities. Noise from Paducah Site activities is restricted generally to the interior of plant facilities and is associated with ongoing D&R activities at the site. Such activities include limited construction and demolition activities and truck and vehicular traffic, which occur at the site on a daily basis. (Note: These actions are addressed by other NEPA evaluations, as discussed in Section 1.3.) Noise levels beyond the plant security fence generally are the result of vehicular traffic moving through the area (refer to Figure 2). On-site waste storage, staging, treatment, transportation, and supporting activities would not involve using large machinery or other noisy equipment other than trucks for waste transport. As a result, any increase in noise level at the Paducah Site as a result of on-site activities associated with either of the alternatives is expected to be small. A temporary minor increase in noise levels may be experienced during construction activities to convert existing facilities to waste storage facilities under the No Action Alternative.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. A negligible increase in noise levels would be expected from the additional truck and railroad traffic resulting from the off-site waste transportation activities.

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Cultural, Archaeological, and Native American Resources	On-site waste storage, staging, treatment, transportation, and supporting activities	A cultural resources survey conducted of PGDP and approved by the Kentucky State Historic Preservation Office (SHPO) identified a National Register of Historic Places (NRHP)-eligible historic district at the Paducah Site. The potentially eligible PGDP Historic District contains 119 buildings and structures, 101 of which would be considered as contributing to the district's character. As identified in the cultural resources survey, these properties are significant under NRHP criterion A and criteria consideration G for their significance in Cold War history and for their role in development of America's commercial nuclear industry (BJC 2006a). No NRHP-eligible archaeological sites have been recorded within the industrialized portion of the Paducah Site. On-site waste storage, staging, treatment, transportation, and supporting activities would use existing facilities and infrastructure. Because no new ground disturbance is anticipated under either of the alternatives, impacts on potential buried archaeological resources not already disturbed by previous development and construction activities at the Paducah Site are unlikely. In addition, use of existing facilities and lack of planned new construction are unlikely to alter physically or introduce visual impacts that may result in adverse effects to architectural resources previously recommended as NRHP-eligible. As a result, no impacts on existing cultural, archaeological, and Native American resources are anticipated. In the event that facility modifications or upgrades are required under either of the alternatives, additional consideration, per 36 *CFR* Part 800, would be given to assess the potential to adversely affect historical properties. In such case, DOE actions would comply with the provisions of the Kentucky SHPO-approved Cultural Resources Management Plan (CRMP) (BJC 2006b). Similarly, if any cultural resources are discovered during implementation of either of the alternatives, consultation with the Kentucky SHPO would be undertaken, as appropriate, in accordance with the Kentucky SHPO-approved CRMP.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. Negligible impacts on cultural resources off-site are anticipated because the existing roadways, railroads, and immediately surrounding areas already have been disturbed by previous development and construction activities, and near-term emergency response actions would be implemented for any accidents, such as a waste spill or release, during transport in accordance with waste transportation regulations. If any cultural resources are discovered during implementation of the alternatives evaluated in this EA, consultation with the appropriate SHPO

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Cultural, Archaeological, and Native American Resources (Continued)	Off-site waste transportation (applicable only to Proposed Action) (Continued)	and Tribal governments would be undertaken as appropriate in accordance with applicable regulations.
Socioeconomics and Environmental Justice	On-site waste storage, staging, treatment, transportation, and supporting activities	The socioeconomics and environmental justice Region of Influence (ROI) consists of a five-county area in western Kentucky (McCracken, Ballard, Carlisle, Graves, and Marshall) and one county in southern Illinois (Massac). The ROI reflects where most current Paducah Site workers live and the local economics/markets where these workers spend much of their wages. Paducah is the primary city in the ROI with a U.S. Census Bureau (USCB) 2017 population estimate of 24,841, which constitutes approximately 38% of the total population of McCracken County (USCB 2017). Paducah is the only city with a population of more than 10,000 in the ROI, and it serves as the regional employment center in the ROI. Current employment by DOE and its contractors at the Paducah Site is approximately 1,300, which is about 4% of the total employment in McCracken County (FRNP 2019c). Any temporary or permanent increase in the site workforce or population of the ROI from either of the alternatives is expected to be minimal compared to current population of the ROI; and an increase would have a negligible effect on the abilities of the communities and institutions in the ROI to provide housing, schools, health care, and other community services at their sustained levels of quality to the existing population. If other than negligible effects were to occur, then the effects likely would be positive through addition of jobs and income in the ROI. Environmental, health, and occupational safety impacts are expected to be minimal, temporary, and confined to the Paducah Site. There would be no disproportionately high and adverse human health effects or environmental impacts on minority or low-income populations; therefore, no impact on environmental justice in the ROI is anticipated.
	Off-site waste transportation (applicable only to Proposed Action)	Off-site waste transportation to existing licensed or permitted waste facilities would utilize existing roadway and railroad transportation routes. As a result, negligible impacts on socioeconomics and environmental justice are anticipated along these transportation routes.

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Climate Change	On-site waste storage, staging, treatment, transportation, and supporting activities	Greenhouse gas (GHG) emissions for on-site waste storage, staging, treatment, transportation, and supporting activities would be created from the use of mobile equipment during these activities. The on-site vehicles utilized for the transport of waste would result in a negligible increase over current on-site vehicle usage for other D&R activities. Paducah Site reported 7,440 metric tons of carbon dioxide equivalent (CO_2e) emissions for 2017. McCracken County reported 7,196,270 metric tons of CO_2e, which included emissions from industrial facilities only, primarily the Tennessee Valley Authority (TVA) Shawnee Fossil Plant north of the Paducah Site (EPA 2019a). Even if the GHG emissions from the Paducah Site were to double as a result of on-site waste transportation activities, which is a conservatively high estimate, the increase would be only 0.001% of the 2017 GHG emissions in McCracken County. The GHG emissions from the on-site activities, therefore, would have a negligible impact on global climate change.
	Off-site waste transportation (applicable only to Proposed Action)	GHG emissions from the off-site waste transportation were estimated for the projected waste shipments of the Proposed Action evaluated in this EA. There would be no off-site transport of waste for the No Action Alternative evaluated in this EA. Based on 3,063 truck shipments (including R-114 shipments) of 1,790 miles, including return shipment, the GHG emissions would be estimated to be 16,700 metric tons for transport by truck for the entire project or 1,400 metric tons per year. Similarly, based on 225 rail shipments of 1,124 railcars (including R-114) of 2,388 miles one way per year to the Richland, WA, the GHG emissions would be estimated to be 47,600 metric tons for transport by rail for the entire project or 4,000 metric tons per year. These are conservative estimates because shipments of shorter distances to closer facilities would not result in as high GHG emission. The national GHG emissions from rail and medium and heavy duty truck transportation for calendar year 2017, was reported as 41,900,000 and 436,500,000 metric tons, respectively (EPA 2019b). Assuming that the annual truck and rail shipments from the Paducah Site to the treatment and disposal facilities would result in additional emissions that otherwise would not be generated, the increase would be only 0.009% for rail and 0.0003% for truck transportation. The GHG emissions from the off-site waste transportation, therefore, would have a negligible impact on global climate change.

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Climate Change (Continued)	Climate change's effect on on-site waste storage, staging, treatment, transportation, and supporting activities	The current estimate for climate change within the United States projects that the average temperatures would increase 2°F to 4°F over the next few decades and a zero projected increase in water level of the Ohio River (Melillo et al. 2014). The time frame evaluated in this EA is 12 years, which is within the cited time frame of this climate change document. Climate change would have a negligible impact, therefore, on the on-site activities under either of the alternatives.
	Climate change's effect on off-site waste transportation (applicable only to Proposed Action)	Climate change would affect transportation systems directly, through infrastructure damage, and indirectly, through changes in trade flows, agriculture, energy use, and settlement patterns. A National Surface Transportation Policy and Revenue Commission in 2007 forecasted the following annual average growth rates: average annual tonnage growth rates of 2.1% for trucks and 1.9% for rail through 2035 (Melillo et al. 2014). Many coastal areas in the United States, including the Gulf Coast, are especially vulnerable to sea level rise impacts on transportation systems. There is only one waste disposal facility, Veolia Environmental Services, that would be considered to be located in a coastal area; therefore, climate change would have a negligible impact on off-site waste transportation under the Proposed Action.
Waste Management	Off-Site Waste Treatment and Disposal (applicable only to Proposed Action)	The off-site treatment and disposal facilities that would be used to treat or dispose of the waste from the Proposed Action are required to operate within the bounds of federal and state requirements, such as the NRC or Agreement State licenses; RCRA permits; air and water permits; and Occupational Safety and Health Administration regulations. The waste planned to be transported is typical of waste being treated and/or disposed of at DOE and commercial waste treatment and/or disposal facilities. Treatment and/or disposal of the waste at any of the facilities would be conducted in accordance with the facility's operating license, permit, or authorization. Because the potential impacts at these disposal facilities were considered as part of the licensing/permitting/authorization process for these sites, there would be no additional impact to the off-site public or on-site workers than expected under these licenses/permits/approvals. Sufficient disposal capacity is available at the off-site disposal facilities to allow disposal of the wastes from the Proposed Action during the 12-year time period at any one or more of the designed facilities. Remaining disposal capacities at the off-site disposal facilities[a] as of October 2019 are as follows (FRNP 2019a):

Table 5. Subject Areas Dismissed from Detailed Analysis (Continued)

Subject Area	Activities Evaluated	Evaluation
Waste Management (Continued)	Off-Site Waste Treatment and Disposal (applicable only to Proposed Action) (Continued)	• Energy*Solutions,* Clive, UT—130,000,000 ft^3 • WCS — Federal Waste Facility—25,662,000 ft^3 — Treatment, Storage, and Disposal Facility Low Activity Waste Disposal Cell—50,490,000 ft^3 • NNSS — MLLW—980,000 ft^3 — LLW—13,000,000 ft^3
[a] Only the remaining capacity for disposal is shown for the facilities designated potentially to receive LLW and MLLW. Less than 1% of the total waste volume is nonradioactive RCRA hazardous waste; with the number of different potential off-site disposal facilities identified in this EA, disposal of the 33,000 ft^3 of nonradioactive RCRA hazardous waste over the 12-year period will not represent a substantial impact to any one facility.		

3.2 SUBJECT AREAS EVALUATED IN FURTHER DETAIL

This section of the EA describes the areas of the affected environment for which potential environmental impacts of the Proposed Action and No Action Alternative are evaluated in further detail in Section 4 (Environmental Consequences) and Section 5 (Cumulative Impacts). The descriptions of the affected environment in this section are grouped according to whether the subject area is on-site or off-site. Air quality, demography and occupational and public health and safety, and accidents and intentional destructive acts are discussed under on-site affected environment. The off-site affected environment is focused on transportation and includes descriptions of the proposed highway (truck) and railroad transportation routes and air quality along the transportation routes.

3.2.1 On-Site Affected Environment

The following are the subject areas described under the on-site affected environment.

- Air quality
- Demography and on-site worker and public health and safety
- Accidents and intentional destructive acts

3.2.1.1 Air quality

The Paducah area is in the Paducah-Cairo Interstate Air Quality Control Region. The Commonwealth's Ambient Air Quality Standards for six criteria air pollutants [sulfur oxides as sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than 10 micrometers (PM_{10}) and particulate matter with an aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), carbon monoxide (CO), ozone, nitrogen dioxide, and lead] are identical to the National Ambient Air Quality Standards (NAAQS) [401 *Kentucky Administration Regulation* (*KAR*) Section 53:010]. The primary ambient air quality standards, which are for the protection of public health, and the secondary ambient air quality standards, which are for the protection of welfare and the environment, are listed in Table 6. In addition, Kentucky has promulgated ambient standards for hydrogen sulfide, gaseous and total fluorides, and odors. These standards also are shown in Table 6.

Table 6. Commonwealth of Kentucky's Ambient Air Quality Standards and Highest Background Levels Representative of the Paducah Area[a]

Pollutant	Primary Standard	Secondary Standard	Highest Background Level
Sulfur oxides			
• Annual arithmetic mean	• 0.030 ppm	• No data	• No data
• 1-hour average	• 75 ppb	• No data	• 14 ppb
• 3-hour average	• No data	• 0.5 ppm	• No data
• 24-hour average	• 0.14 ppm	• No data	• No data
Particulate matter, measured as PM_{10}			
• 24-hour average	• 150 $\mu g/m^3$	• Same as primary	• 27 $\mu g/m^3$
Particulate matter, measured as $PM_{2.5}$			
• Annual arithmetic mean, 2012 standard	• 12.0 $\mu g/m^3$	• Same as primary	• 8.6 $\mu g/m^3$
• 24-hour average	• 35 $\mu g/m^3$	• Same as primary	• 18 $\mu g/m^3$
Carbon monoxide			
• 8-hour average	• 9 ppm (10 mg/m^3)	• No data	• 0.3 ppm
• 1-hour average	• 35 ppm (40 mg/m^3)	• No data	• 0.3 ppm
Ozone ($\mu g/m^3$)			
• 1-hour average	• 0.12 ppm	• Same as primary	• No data
• 8-hour average 2015 standard	• 0.070 ppm	• Same as primary	• 0.064 ppm
Nitrogen dioxide ($\mu g/m^3$)			
• Annual arithmetic mean	• 53 ppb	• Same as primary	• 5 ppb
• 1-hour average	• 100 ppb	• No data	• 34 ppb
Lead			
• Rolling -3-month mean	• 0.15 $\mu g/m^3$	• Same as primary	• 0.02 $\mu g/m^3$
Hydrogen sulfide ($\mu g/m^3$)			
• 1-hour average	• No data	• 14 $\mu g/m^3$ (0.01 ppm)	• No data
Gaseous fluorides, expressed as hydrogen fluoride			
• Annual arithmetic mean, not to exceed	• 400 $\mu g/m^3$ (0.05 ppm)	• No data	• No data
• 1-month average	• No data	• 0.5 (0.6 ppb)	• No data
• 1-week average	• 800 $\mu g/m^3$ (1.0 ppm)	• 0.8 (0.97 ppb)	• No data
• 24-hour average	• No data	• 2.86 (3.5 ppb)	• No data
• 12-hour average	• No data	• 3.68 (4.5 ppb)	• No data

Table 6. Commonwealth of Kentucky's Ambient Air Quality Standards and Highest Background Levels Representative of the Paducah Area[a] (Continued)

Pollutant	Primary Standard	Secondary Standard	Highest Background Level
Total fluorides (ppm) Dry-weight basis (as fluoride ion) in and on forage for consumption by grazing ruminants. The following concentrations are not to be exceeded:			
• Average concentration of monthly samples over growing season (not to exceed 6 consecutive months)	• No data	• 40 ppm	• No data
• 2-month average	• No data	• 60 ppm	• No data
• 1-month average	• No data	• 80 ppm	• No data

Source: 401 *KAR* Sections 53:005 and 53:010.

[a] Based on EPA's 2017 air quality design values and Air Quality System database (EPA no date available).

$\mu g/m^3$ = microgram(s) per cubic meter

mg/m^3 = milligrams per cubic meter

PM_{10} = particulate matter 10 micrometers or less in diameter

$PM_{2.5}$ = particulate matter 2.5 micrometers or less in diameter

ppb = part(s) per billion

ppm = part(s) per million

The regulations that implement how the ozone layer is to be protected are contained in 40 *CFR* Part 82. The purpose of 40 *CFR* Part 82 is to implement the Montreal Protocol and Clean Air Act and applies to any person who produces, transforms, destroys, imports, or exports a controlled substance or product, such as R-114. It requires service practices that maximize recycling of ODSs during servicing and disposal and sets certification requirements for recovery and recycling equipment.

Current air quality is in attainment in the Paducah area. The area is designated as a Class II prevention of significant deterioration (PSD) area. New emission sources are not permitted to degrade air quality above the applicable limits, defined in terms of maximum ambient air increments established for a Class II area (401 *KAR* Section 51:017). The nearest Class I PSD areas, where more stringent ambient air quality requirements must be met, are the Mingo National Wildlife Refuge in Missouri, approximately 90 miles west of the Paducah Site, and Mammoth Cave National Park in Mammoth Cave, KY, 135 miles east of the Paducah Site (EPA 2019c).

3.2.1.1.1 Ambient air monitoring near the Paducah Site

The ambient air quality is monitored regularly at the Paducah Site and surrounding area. Table 6 lists the highest background concentrations that can be considered representative of the Paducah Site and surrounding area, based on EPA's Air Quality Design Values for McCracken County 2017 background data (EPA no date available).

The Paducah area, including the Paducah Site, currently is in attainment for all criteria pollutants. This means that air quality at the Paducah Site and surrounding area is better than the thresholds for ambient air quality listed in Table 6. The largest air pollution source near the Paducah area is TVA's coal-fired Shawnee Fossil Plant, approximately 3 miles north-northeast of the Paducah Site. Other air emission sources at or near the Paducah Site include the DUF_6 Conversion Facility, also located on DOE property, and the Joppa Power Plant, located across the Ohio River in Illinois, approximately 6 miles northwest of the Paducah Site.

3.2.1.2 Demography and worker and public health and safety

3.2.1.2.1 Worker population

The on-site worker population at the Paducah Site includes persons working for DOE and its contractors. As of April 2019, DOE and its contractors employed approximately 1,300 full-time equivalent (FTE) workers at the Paducah Site (FRNP 2019c), a reduction of about 19% since October 2014 when the leased uranium enrichment facilities at the Paducah Site were returned to DOE from USEC, at which time the employed workers at the site totaled approximately 1,600 (FRNP 2018c).

For the Proposed Action, approximately 45 FTE workers or approximately 3% of the total workers at the Paducah Site as of April 2019 are estimated to be involved in on-site waste activities analyzed in this EA. This includes operators, field line managers, radiological technicians, industrial hygiene, safety, characterization/sampling, and waste transportation support personnel (FRNP 2019d). This includes 1 FTE to account for other workers involved in various other supporting waste disposition activities on an intermittent basis. This does not include on-site workers involved in the generation of the waste analyzed in this EA.

3.2.1.2.2 Area off-site population

The city limits of Paducah, KY, and Metropolis, IL, are 10 miles east, and approximately 5 miles north and east of the Paducah Site, respectively. The populations of Paducah and Metropolis were about 24,841 and 6,482 (USCB 2017), respectively. Two unincorporated communities, Grahamville and Heath, are located

approximately 2 miles east of the plant. Communities within a 15-mile radius of Paducah Site include Brookport, IL (10 miles east, 984 population); Kevil, KY (5 miles southwest, 376 population); and La Center, KY (13 miles southwest, 1,009 population) (FRNP 2019b).

Nearby residences mostly lie along Kentucky Highway 996, which is about 1 mile east of and generally parallel to the eastern edge of the site. The maximally exposed individual (MEI) is assumed to be located at the West McCracken County Fire Station 1, just east of Kentucky Highway 996, just over 1 mile east of the Paducah Site. Residences located to the south, west, and north of the DOE property boundary are sparser and further removed from the boundary than those located to the east (FRNP 2019b).

The current population density within a 5-mile radius of the Paducah Site is approximately 78 person/mile^2 and is projected to remain the same through 2030, based on data from the Kentucky State Data Center projections of county population growth rate (FRNP 2019b).

Other populations within an approximate 5-mile radius of the Paducah Site include (FRNP 2019b):

- Two schools (Heath Elementary and Middle Schools) with school populations, including students, teachers, and staff of 1,023 in 2013-2014.
- The McCracken County High School just beyond the 5-mile radius with a 2013–2014 school population of 2,089.
- Three day care centers with a capacity of 148.
- Heath Elementary School before-and-after school programs with a maximum capacity of 150.
- An assisted living facility with a capacity of 16 in Kevil, KY.
- Apartments for the elderly consisting of 18 units in Kevil, KY.
- Barkley Regional Airport located approximately 4 miles south-southeast employing 150 persons.
- U.S. Army Reserve and Kentucky National Guard installation on the Barkley Regional Airport grounds that is staffed with approximately 300 soldiers.
- Transient recreational populations also within an approximate 5-mile radius of the Paducah Site:
  - WKWMA recreational users, estimated at 53 persons per day.
  - Harrah's Casino with approximately 2,100 people per day.

3.2.1.2.3 Worker and public health and safety

DOE Order 458.1, *Radiation Protection of the Public and the Environment*, sets an annual individual dose limit to members of the public of 10 millirem (mrem) (or 1.0E-02 rem) from airborne pathways, 4 mrem (or 4.0E-03 rem) from the drinking water pathway, and 100 mrem (or 1.0E-01 rem) total from all pathways for protection of the public and the environment. Public doses from all pathways must be maintained to achieve as low as reasonably achievable (ALARA) goals. To protect workers from impacts from radiological exposure, DOE's Occupational Radiation Protection regulation, 10 *CFR* Part 835, sets an individual dose limit of 5,000 mrem (or 5 rem) per year. Doses to workers also are monitored and controlled below the regulatory limit to ensure that individual doses are less than an administrative limit of 2,000 mrem (or 2.0E+00 rem) per year and maintained to achieve ALARA goals. For comparison, in 2017, the most

recent year for which annual data are available, DOE reported that 5.2E+00 p-rem of collective radiation dose was recorded by 113 workers at Paducah (DOE 2018a). This is an average of 4.6E-02 rem per year per exposed worker. No other workers received measurable radiation doses.

Nonradiological health impacts may occur primarily through inhalation of air containing hazardous chemicals released to the atmosphere. Impacts are minimized through design, construction, and administrative controls that limit hazardous chemical releases to the environment and achieve compliance with National Emissions Standards for Hazardous Air Pollutants and Kentucky Pollutant Discharge Elimination System requirements. The effectiveness of these controls is verified through the use of environmental monitoring data and inspection of mitigation measures (FRNP 2019e).

Nonradiological impacts to workers at the Paducah Site could occur through exposure to hazardous waste and materials by inhaling contaminants in the workplace atmosphere or by direct contact. Workers are protected from workplace hazards through appropriate training, protective equipment, monitoring, materials substitution, and engineering and management controls. Compliance with federal and state laws, DOE Orders and regulations, and Occupational Safety and Health Administration requirements also helps protect workers. DOE requires that conditions in the workplace be as free as possible from recognized hazards that cause or are likely to cause illness or physical harm.

3.2.1.3 Accidents and intentional destructive acts

Emergency Planning Hazards Assessment (EPHA)*,* CP2-EP-3000, describes the application of hazard and accident analysis techniques that provide sufficient detail to assess a spectrum of postulated events, that is, accidents and malevolent or intentional destructive acts, involving the uncontrolled release of hazardous materials and evaluates the ensuing consequences for the Paducah Site (FRNP 2019b). The EPHA addresses all activities and materials on-site and is not limited to only those activities, wastes, and materials analyzed in this EA. The EPHA is a comprehensive analysis of all activities and materials on-site that would cover the materials and activities addressed in this EA. Thus, the EPHA provides reasonable assurance that the potential failures, hazards, accident sequences, and scenarios have been investigated comprehensively for the purpose of the Proposed Action and No Action Alternative evaluated in this EA. Consequence assessment of hazardous material releases provides the means to determine the potential for the need to declare an Alert or Site Area Emergency at the Paducah Site.

The accidents analyzed in EPHA include the following:

- Impact and fire from possible initiating events of aircraft impact and/or malevolent acts;
- Full, medium and small facility fire from possible initiating events of vehicle impact and fire, fuel pool fire, combustible fire, and external fire propagation;
- Large and small explosions from possible initiating events of malevolent acts and forklift/vehicle explosion;
- Large, medium, and small loss of confinement from possible initiating events of seismic natural phenomena, mobile crane or equipment impact, missile(s) impact(s) from distant explosion, partial roof collapse; high wind natural phenomena, handling accident, flooding, and vehicle impact; and
- Drum deflagration from possible initiating events of drum overpressurization and deflagration.

Malevolent or intentional destructive acts evaluated included the use of explosive or flammable material. In most cases, intentional destructive acts will produce releases and consequences similar to those that could

be caused by accidental, natural phenomena, or other external initiating events. DOE G 151.1-2 groups intentional destructive acts with catastrophic events; therefore, catastrophic events, as used in the EPHA and this EA, include intentional destructive acts or events, unless stated otherwise. Examples of catastrophic events presented in DOE G 151.1-2 include major fires, airplane crashes, building collapse, dam failure, meteor strike, nuclear detonation, and severe natural phenomena.

A documented safety analysis for the Paducah Site determined that a large aircraft crash into one of the Paducah Site facilities is an extremely low probability event, that traffic accidents on public highways near the plant resulting in explosions would not affect Paducah Site operations, and that barge accidents resulting in the explosion of material being transported on the Ohio River would have minimal impact on the site. As discussed in the EPHA, multi-facility, common cause release events are unlikely to occur at the Paducah Site (FRNP 2019b; FRNP 2018c).

Activities at the Paducah Site are primarily mechanical in nature. The wastes and excess materials analyzed in this EA would be generated from the shutdown process buildings and other site facilities and would involve activities including, but not limited to, characterization, sampling, storage, staging, packaging/overpackaging/repackaging, treatment, loading, and transportation. The EPHA analyzed potential releases of materials from accidents ranging from minor to beyond design basis for the facilities at the Paducah Site, including accidents and resulting releases encompassing the on-site waste storage and staging areas. As a result, the hazard analyses provided in the documents cited above were considered to be sufficient for use in this EA.

Intentional destructive acts and catastrophic events were postulated as appropriate, typically using bounding inventories, including maximum waste storage capacities within the waste storage facilities. The resulting human consequences included radiological exposure, toxic and hazardous chemical exposure, and industrial hazards leading to injuries and fatalities.

Two evaluated accident events at one of the permitted waste storage facilities, C-746-Q, were selected from the EPHA to support the analyses in this EA: a large loss of confinement (seismic natural phenomena) and a small loss of confinement. The C-746-Q Complex (C-746-Q) consists of facilities C-746-Q and C-746-Q1. C-746-Q is a warehouse facility that is located in the southeastern portion of the facility (see Figure 3). The C-746-Q is used to store fissile and nonfissile materials and wastes. The C-746-Q is a single story, prefabricated, pre-engineered facility with metal siding and measures 272 ft by 180 ft. The facility has a wall that separates the Q and Q1 portions of the facility. C-746-Q is operated under a RCRA hazardous waste management permit while the other side, C-746-Q1, does not require a permit.

The large loss of confinement accident at C-746-Q resulted in impacts equivalent to accidents involving an aircraft impact and fire and a full facility fire. For the consequence analysis, radiological and non-radiological (that is, chemical) inventories were considered. The radiological materials in C-746-Q include various radionuclides represented as radionuclide U-238 equivalent (U-238eq) and the non-radiological materials include UF_6 and uranyl fluoride (UO_2F_2), a reaction product of UF_6 and moist air. Uranium is considered in both radiological and non-radiological inventories because its toxicological effects may be more hazardous than its radiological effects (FRNP 2019b).

3.2.1.3.1 Accident evaluation for large loss of confinement

The large loss of containment (LOC) accident would possibly result from a seismic natural phenomena. The Paducah Site is located near the northern limit of the New Madrid Seismic Zone, approximately 19 miles southwest of the Paducah Site. Because of its proximity to the New Madrid Seismic Zone, there is a moderately high probability that earthquakes will occur within the next 50 years, some of which may be felt at the surface. Estimates obtained from the U.S. Geological Survey website indicate that the

probability of occurrence of a 7.5 magnitude earthquake in the next 50 years is 3% to 4% (FRNP 2019b). The annual probability of this earthquake occurrence is as follows:

$$0.04 \div 50 \text{ years} = 0.0008 \text{ per year or } 8.E\text{-}4 \text{ per year}$$

A sufficiently large earthquake (that is, 7.5 magnitude or greater) could cause radiological and nonradiological (that is, chemical) releases from multiple buildings, and fire(s) may ensue. An earthquake large enough to cause multiple-facility releases of concern likely would bury hazardous solids in rubble. Likewise, hazardous liquids would be buried in rubble and might find a pathway to the soil/ground.

For the event of a large loss of confinement in the C-746-Q facility, it was assumed that the entire inventory of the radiological and nonradiological (that is, chemical) inventories in the C-746-Q waste storage facility were impacted. Any secondary barriers (such as, facility structure) were assumed to be breached and not available to contribute to mitigation of a release. Although a seismic event was the chosen initiator for the large LOC at C-746-Q, the EPHA notes that other natural phenomena, such as a tornado, could cause a large LOC with similar results.

3.2.1.3.2 Accident evaluation for small loss of confinement

The evaluated small loss of confinement accident would possibly result from an equipment impact, handling accident, vehicle/forklift impact, or partial roof collapse involving multiple containers within the facility. For the event of a small loss of containment, 10% of the UF_6 inventory stored at the facility was released. Any barriers or secondary barriers were assumed to be breached and not available to contribute to mitigation of a release. The probability of a small loss of confinement accident occurring was estimated to be 1.E-02 per year based on the vehicle impact/mishandling frequency in the 2002 EA (DOE 2002a).

3.2.2 Off-Site Affected Environment

The off-site affected environment is limited to the transportation routes that would be used to transport deactivation and other non-CERCLA wastes to off-site DOE and commercial treatment and disposal sites. Because environmental consequences at these off-site facilities were considered as part of the licensing/permitting/approval process for these sites, there would be no additional exposure than that expected to the off-site public or on-site workers under these licenses/permits/approvals, and those impacts are not detailed in this EA. Table 5 describes the subject areas of the potentially affected environment along the transportation routes that were dismissed from detailed analysis. The transportation routes and air quality along the routes are the only areas analyzed in detail (in this section).

The Paducah Site is accessed primarily via U.S. Highway 60. U.S. Highway 60 connects to Interstate 24, which passes through Paducah, KY, approximately 10 miles east of the Paducah Site. The main entrance to the Paducah Site from U.S. Highway 60 is via Hobbs Road, approximately 1 mile north of U.S. Highway 60 on Hobbs Road. Three additional federal highways (U.S. 45, 62, and 68) and many state highways are located within 10 miles of the Paducah Site. The Paducah Site is located in a secured area; therefore, traffic is minimal around the site and immediately surrounding area and generally is limited to trucks or service vehicles accessing the facility. Rail access is available to and on-site at the Paducah Site.

3.2.2.1 Transportation routes from the Paducah Site

The waste in this EA will be transported to any of the disposal facilities listed in Table 4 (Section 2.1). The maximum reasonably foreseeable options to bound the Proposed Action will be the railroad route to Richland, WA, and the truck route to Mercury, NV. Although these options were used to calculate the maximum reasonably foreseeable scenario for transportation, meaning 100% of the waste shipped to each of these destinations, any of the routes and treatment or disposal facilities may be used for the Proposed

Action. Wastes will be transported in DOT-approved containers that meet the requirements of the waste receiver. DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations. Wastes can be transported by commercial trucks along interstate highways or other primary highways suited to cargo-truck transport. Waste meeting the criteria for highway route controlled quantity will not be generated or shipped from the Paducah Site as part of the proposed action. Wastes also can be transported by rail via existing commercial rail routes. Transportation routes for R-114 are included separately in Sections 3.2.2.1.3 and 3.2.2.1.4.

All DOE shipments of radioactive and hazardous waste or materials will follow applicable laws and regulations. Transportation of radioactive waste or materials is regulated strictly. The DOT regulates packaging, labeling, handling, marking, and placarding of shipments; and preparing of shipping papers. The DOT establishes standards for personnel, conveyance (e.g., truck and train) performance, and maintenance. The DOT and the NRC set radioactive material packaging standards. Specific details of these regulations can be found in 49 *CFR* Parts 106, 107, and 171–178 (DOT regulations); and 10 *CFR* Parts 20, 61, and 71 (NRC regulations). In accordance with DOE Order 460.2A, DOE shipments must comply with applicable internal DOE requirements.

3.2.2.1.1 Highway routes from the Paducah Site to proposed waste treatment and disposal sites

The highway routes from the Paducah Site to the proposed waste treatment and proposed disposal sites in the Proposed Action are provided in Table 7, which also lists representative transfer routes that may be used to ship processed wastes between treatment and disposal facilities.

Representative highway transportation routes between the proposed disposal destinations and the Paducah Site are shown on Figure 4. Routes were selected based on best available data for existing routes.

Table 7. Highway Route Distances from the Paducah Site to Proposed Waste Treatment and Disposal Destinations

Facility	Location	Distance (miles)[a]
Waste Treatment and Disposal Destinations		
Perma-Fix Diversified Scientific Services, Inc.	Kingston, TN	295
Energy*Solutions*	Oak Ridge, TN	312
Clean Harbors Spring Grove Resource Recovery	Cincinnati, OH	320
Clean Harbors	El Dorado, AR	435
Evoqua Water Technologies	Darlington, PA	615
Perma-Fix of Florida	Gainesville, FL	731
Clean Harbors-Deer Park	La Porte, TX (2027 Independence Parkway)	762
Clean Harbors	La Porte, TX (500 Independence Parkway)	765
Clean Harbors	Reidsville, NC	648
WCS	Andrews, TX	1,023
Energy*Solutions*	Clive, UT	1,562
NNSS	Area 5 (Mercury, NV)	1,790
Perma-Fix Northwest	Richland, WA	2,065

[a] Routes are based on best available data and are subject to change.

The shortest-distance and shortest-time routes were compared, and little difference was identified; therefore, shortest distance routes were used for analysis. Figure 4 also shows representative transfer routes that may be used to ship processed wastes between facilities. These transfer route shipments are the responsibility of the licensed or permitted contracted facilities and are not included in the impact

Figure 4. Representative Highway Routes for Waste Transportation

calculations in this EA. Because the potential impacts at these off-site transfer facilities were considered as part of the licensing/permitting/approval process for these sites, there would be no additional exposure than that expected to the off-site public or on-site workers under these licenses/permits/approvals, and those impacts are not detailed in this EA. The following constraints were applied in truck route selection.

- Avoidance of road segments prohibiting truck use;
- Following of DOT docket number HM-164/state-preferred routes for high-level radioactive waste;
- Avoidance of ferry crossings; and
- Avoidance of access roads between nonintersecting interstate highways.

Waste treatment may be conducted at the Paducah Site, other DOE sites, or commercial treatment facilities. The Energy*Solutions*/Perma-Fix Diversified Scientific Services, Inc., (DSSI) route outlined on Figure 4 serves as a representative route to any of several commercial treatment facilities (Perma-Fix or Energy*Solutions*) in the Oak Ridge and Kingston, TN, areas.

3.2.2.1.2 Rail routes from the Paducah Site to treatment and disposal sites

Representative rail routes between the Paducah Site and proposed treatment and disposal destinations are shown on Figure 5. Table 8 includes the name and location of the treatment and disposal destinations, along with the approximate distances of the proposed rail routes.

3.2.2.1.3 Truck routes for R-114 transport from Paducah Site to treatment and disposal sites

The highway routes for transporting R-114 from the Paducah Site to representative treatment and proposed disposal sites in the Proposed Action are provided in Table 9 and shown on Figure 6.

Figure 5. Representative Rail Routes for Waste Transportation

Table 8. Rail Route Distances from the Paducah Site to Proposed Waste Treatment and Disposal Destinations

Facility	Location	Distance (miles)[a]
Clean Harbors	El Dorado, AR	441
Energy*Solutions*	Oak Ridge, TN	496
Perma-Fix Diversified Scientific Services, Inc.	Kingston, TN	496
WCS	Andrews, TX	1,600
Energy*Solutions*	Clive, UT	1,845
Perma-Fix Northwest	Richland, WA	2,388

[a] Routes are based on best available data and are subject to change.

Table 9. Highway Route Distances for Transport of R-114 from the Paducah Site to Each Proposed Destination

Facility	Location	Distance (miles)[a]
Perma-Fix Diversified Scientific Services, Inc.	Kingston, TN	295
Hudson Technologies (Smyrna, GA location)	Atlanta, GA	388
Clean Harbors	El Dorado, AR	426
A-Gas	Bowling Green, OH	511
Heritage Thermal Services	East Liverpool, OH	599
Veolia Environmental Services	Port Arthur, TX	729
Clean Harbors Aragonite Incineration Facility	Grantsville, UT	1,556
Chill-Tek	Las Vegas, NV	1,691

[a] Routes are based on best available data and are subject to change.

Figure 6. Representative Highway Routes for R-114 Transport

3.2.2.1.4 Rail routes for R-114 transport from Paducah Site to treatment and disposal sites

The rail routes for transporting R-114 from the Paducah Site to the representative treatment and proposed disposal sites in the Proposed Action are provided in Table 10 and shown on Figure 7.

Table 10. Rail Route Distances for Transport of R-114 from the Paducah Site to Each Proposed Destination

Facility	Location	Distance (miles)[a]
Clean Harbors	El Dorado, AR	441
Perma-Fix Diversified Scientific Services, Inc.	Kingston, TN	496
Hudson Technologies (Smyrna, GA location)	Atlanta, GA	486
A-Gas	Bowling Green, OH	572
Heritage Thermal Services	East Liverpool, OH	822
Veolia Environmental Services	Port Arthur, TX	862
Clean Harbors Aragonite Incineration Facility	Grantsville, UT	1,845
Chill-Tek	Las Vegas, NV	2,224

[a] Routes are based on best available data and are subject to change.

3.2.2.2 Air quality along transportation routes

The Clean Air Act of 1970, Section 176 (c), requires EPA to establish rules to ensure that federal agency actions conform with state implementation plans. These plans are designated to eliminate or reduce the severity and number of violations of the NAAQS. As a result, EPA promulgated the "General Conformity" rule (58 *FR* Section 63214 through 63259) in November 1993.

This rule applies in areas considered "nonattainment" or "maintenance" for six criteria air pollutants (ozone, CO, SO_2, nitrogen dioxide, particulate matter, and lead). A nonattainment area is an area where the air quality exceeds the allowable NAAQS for one or more pollutants, while a maintenance area is an area that has been redesignated from nonattainment to attainment. The general conformity rule covers direct and indirect emissions of criteria pollutants caused by federal actions that exceed the threshold emissions levels shown in 40 *CFR* Part 93, Subpart 93.153. Each affected state is required by Section 176(c) of the 1990 Clean Air Act amendments to devise a state implementation plan designed to achieve the NAAQS.

DOE has integrated the requirements of the general conformity rule with those of its NEPA process, wherein, for actions not exempted, the total emissions from the Proposed Action are evaluated to determine when they are above *de minimis* thresholds and whether they are regionally important. The following nonattainment areas are associated with each route (EPA 2019c).

- Perma-Fix of Florida, Gainesville, FL (highway): Atlanta, GA
- Perma-Fix Diversified Scientific Services, Inc., Kingston, TN (highway and rail): no nonattainment areas
- Energy*Solution*s, Oak Ridge, TN (highway and rail): no nonattainment areas
- WCS, Andrews, TX (highway and rail): St. Louis, MO and IL; Titus County, TX; and Dallas Fort Worth, TX

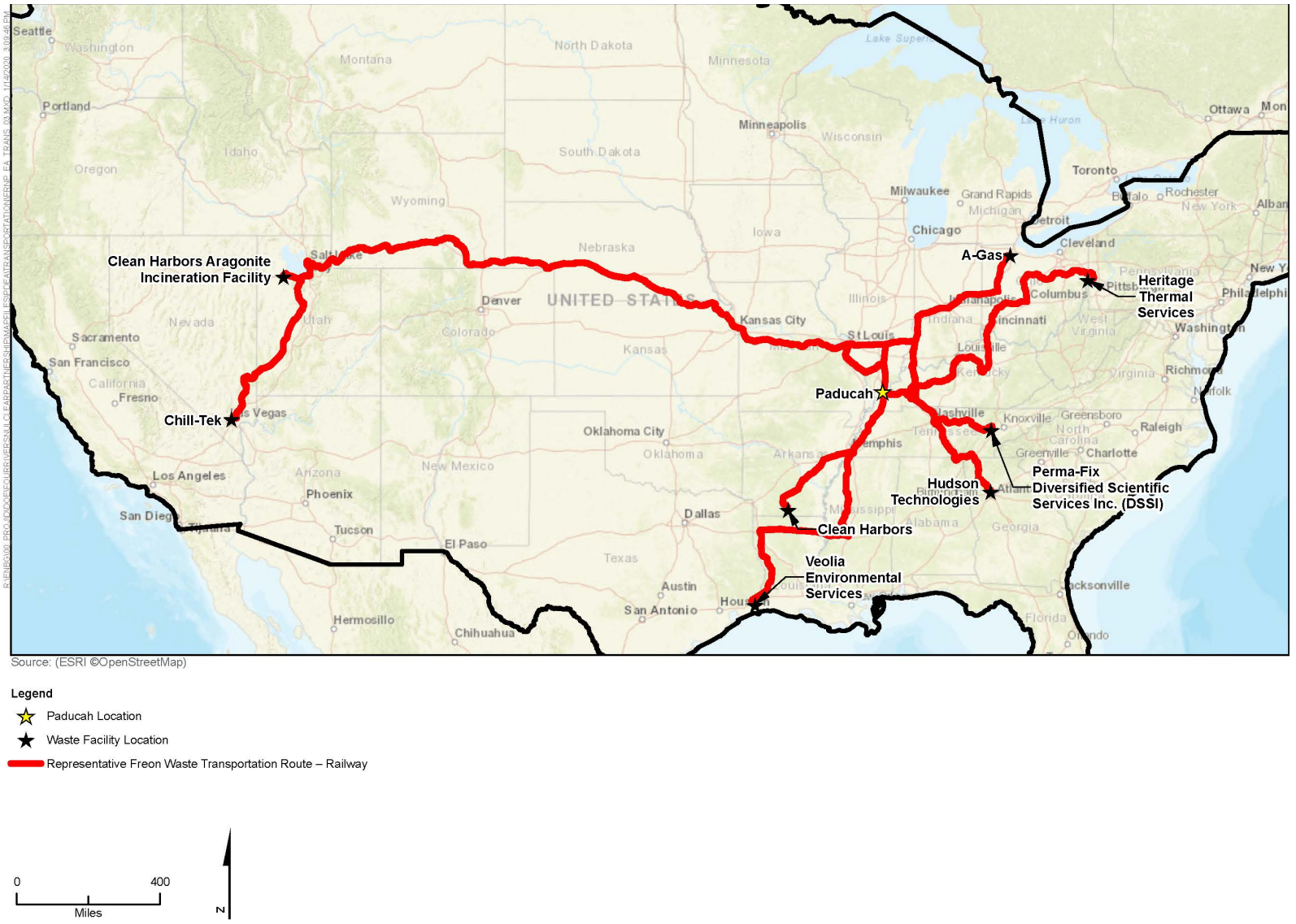

Figure 7. Representative Rail Routes for R-114 Transport

- Energy*Solutions*, Clive, UT (highway): St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; and Salt Lake County, UT

- Energy*Solutions*, Clive, UT (rail): Louisville, KY and IN; Jefferson County, KY; St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; and Salt Lake County, UT

- NNSS, Mercury, NV (highway): San Bernardino County, CA; and Las Vegas, NV

- Perma-Fix Northwest, Richland, WA (highway and rail): St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; Salt Lake County, UT; and Logan, UT-ID

- Clean Harbors, El Dorado, AR (highway and rail): no nonattainment areas

- Clean Harbors Deer Park, La Porte, TX (highway): Rusk and Panola Counties, TX; and Houston-Galveston-Brazoria, TX

- Evoqua Water Technologies, Darlington, PA (highway): Louisville, KY and IN; Jefferson County, KY; Cincinnati, OH and KY; Columbus, OH; Muskingum River, OH; Steubenville, OH and West VA; Pittsburgh-Beaver Valley, PA; and Beaver, PA

- Clean Harbors, La Porte, TX (highway): Rusk and Panola Counties, TX; and Houston-Galveston-Brazoria, TX

- Clean Harbors, Reidsville, NC (highway): no nonattainment areas

- Clean Harbors, CN (Spring Grove), OH (highway): Louisville, KY and IN; Jefferson County, KY; Cincinnati, OH and KY

- A-Gas, Bowling Green, OH (highway and rail): Terre Haute, IN; Southwest Indiana, IN; Morgan County, IN; and Muncie, IN

- Veolia Environmental Services, Port Arthur, TX (rail): no nonattainment areas

- Veolia Environmental Services, Port Arthur, TX (highway): Rusk and Panola Counties, TX

- Chill-Tek, Las Vegas, NV (highway and rail): Louisville, KY and IN; Jefferson County, KY; St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; Salt Lake County, UT; Uintah County, UT; Weber County, UT; Toole County, UT; and Las Vegas, NV

- Heritage Thermal Services, East Liverpool, OH (highway and rail): Louisville, KY and IN; Jefferson County, KY; Cincinnati, OH and KY; Columbus, OH; Steubenville, OH and West Virginia; Pittsburgh-Beaver Valley, PA; and Beaver, PA

- Hudson Technologies, Smyrna, GA, location and Atlanta, GA (highway and rail)

- Clean Harbors Aragonite Incineration Facility, Grantsville, UT (highway): St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; and Salt Lake County, UT

- Clean Harbors Aragonite Incineration Facility, Grantsville, UT (rail): Louisville, KY and IN; Jefferson County, KY; St. Louis, MO and IL; Kansas City (Jackson County, MO), MO and KS; Upper Green River Basin Area, WY; Tooele County, UT; and Salt Lake County, UT

4. ENVIRONMENTAL CONSEQUENCES

This section describes the potential impacts or environmental consequences that would result from implementing the Proposed Action and compares those impacts to potential impacts from the No Action Alternative. This section also describes measures to mitigate environmental consequences of the Proposed Action.

Impacts are characterized and defined as follows.

- No impact—No impact would be expected.
- Negligible—Impacts would not be expected to be measurable.
- Minimal—Impacts would be measurable but within the capacity of the affected system to absorb the change.
- Moderate—Impacts would be measurable resulting in changes on the affected system that may be avoided or minimized with mitigation.
- Large/adverse—Impacts would be measurable and would require mitigation to avoid substantial impacts.

The analysis of environmental consequences is presented for both alternatives (Proposed Action and No Action) in the following subsections: (1) on-site impacts on the affected environment at the Paducah Site and (2) off-site transportation-related impacts, as applicable. The following are the subject areas for which the impacts are analyzed and compared:

- Air quality,
- Radiation and chemical risk to the worker and nearby population, and
- Accidents and intentional destructive acts.

As described in Section 3.1, a number of subject areas were dismissed from detailed analysis in the EA due to either a determination that there would be no impact or that there would be only negligible or minimal impacts to the subject or resource area, and these are not discussed in this section.

4.1 IMPACTS OF THE PROPOSED ACTION

Potential impacts of implementing the Proposed Action are described in the following subsections. As described in Section 2.1 and presented in Table 2, most waste would be treated and disposed of off-site at existing, licensed, and/or permitted or approved DOE and commercial facilities that have been evaluated in other NEPA documents. Only a small percentage of wastes would undergo on-site treatment such as encapsulation and compaction prior to transport to off-site disposal facilities under the Proposed Action. Waste treatment and disposal proposed at off-site DOE and commercial facilities would comply with all applicable licenses, permits, and approvals. The Paducah Site also complies with DOE and site-specific radiological control procedures for the release of materials off-site, including wastes and excess equipment, to ensure that radiologically contaminated materials are not released to facilities that are not authorized to receive radiological materials.

Site impacts from disposal and treatment at off-site facilities are evaluated in site-specific NEPA documents, licenses, and permits, as appropriate, and are not evaluated further in this EA. No new impacts related to off-site treatment or disposal facilities are anticipated. Prior to shipping any wastes off-site, DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements.

Wastes would be transported off-site by truck or rail. DOT-compliant truck and rail transports would be equipped to handle waste movement. Waste transportation to off-site disposal facilities would occur on existing highway and rail infrastructure following applicable federal and state regulations. Except where discussed below, off-site waste transportation would not change the conditions on roadways in a meaningful way and would not be expected to result in other than negligible/minor impacts on environmental resources along the transportation routes.

4.1.1 On-Site Impacts

The following subsections present on-site impacts at the Paducah Site that result from the Proposed Action. Potential off-site (that is, transportation-related) impacts are discussed in Section 4.1.2. The Integrated Safety Management System is a systematic and structured approach to integrating health, safety, security, and quality into work planning and execution for the Paducah Site D&R scope of work to minimize impacts from activities at the Paducah Site. The Environmental Management System integrates environmental protection and compliance, waste minimization and pollution prevention, and site sustainability into the site's Integrated Safety Management System and culture. In addition, several other environmental-based programs are used to foster and support environmental due diligence and to protect Paducah Site resources. Each project task is required to have a waste management plan that specifically relates to the expected waste stream; quantities of waste generated; and information about required container inspection, diking, repackaging of waste, and transference of liquid wastes (FRNP 2018a).

4.1.1.1 Air quality

Overall, air quality impacts associated with on-site waste activities under the Proposed Action would be negligible, localized, and temporary, as described below.

Emissions of criteria pollutants and ODSs (that is, R-114) are the primary concern from area (nonpoint) sources such as waste packaging, sorting, and storage areas. No notable emissions of criteria air pollutants or ODSs are expected from the routine waste storage and supporting activities for waste generated at the Paducah Site. All waste stored would be in stable configurations so that minimal air emissions would occur. All transfers of ODSs for repackaging or storage would be performed by certified technicians complying with 40 *CFR* Part 82 requirements. Liquid and volatile materials would be packaged in a manner that would avoid spillage or release to the atmosphere. Proper containers for the waste would be selected to ensure that emissions to the atmosphere during storage would be minimized. In addition, inspections would be conducted regularly to ensure that container breaches do not occur that could cause release emissions into the air.

Particulate matter would be the primary criteria pollutant emitted during movement of waste to on-site and off-site treatment facilities. All treatment activities would be conducted at existing facilities, so there would be no impacts from construction or site disturbance. The wastes proposed for on-site treatment would be processed by technologies such as stabilization or solidification that historically have not produced notable air emissions. Typically, locations at which the on-site treatment would occur have high-efficiency particulate air filters that would screen out a high percentage of airborne particulate matter resulting from

treatment. These facility controls result in no anticipated ambient air impacts from on-site treatment at the Paducah Site.

Wastewater treatment techniques would be used to remove contaminants from aqueous waste streams that are suitable for on-site discharge to meet applicable discharge limits. Minimal air emissions are expected from the wastewater treatment system because the aqueous waste streams are not notable sources of air pollutants.

Normal operation of waste treatment facilities would not result in adverse impacts to air quality. Normal airborne emissions of chemicals from the treatment processes would be controlled to reduce concentrations to below permissible Clean Air Act environmental and worker exposure limits by high-efficiency particulate air filters or other controls before being emitted from the facility enclosure and, subsequently, from waste processing facilities. Workers inside the treatment facility would be protected from adverse effects of normal emissions of chemicals by the appropriate level of personal protective equipment (PPE). Solid (nonradioactive) wastes resulting from treatment facility normal waste operations would be packaged for subsequent off-site disposal, in accordance with site waste management procedures to mitigate adverse impacts on the environment or public/worker health and safety (FRNP 2018a).

The likelihood of accidents that may affect air quality are low because of mitigative measures such as filters and process controls and the proper training of waste operations personnel (see Section 4.1.1.3, Accident and Intentional Destructive Acts).

The pollutants that would be emitted by transportation vehicles during waste transport on-site include nitrogen oxides, CO, volatile organic compounds, and particulates such as fugitive road dust. Impacts on air quality from the exhaust emissions of the vehicles used to transport wastes through the Paducah Site would be very small because only a few vehicles and a small number of daily or weekly trips would be involved; approximately 2 shipments could occur per week on average over the life of the proposed action. Transportation would impact the ambient air quality for a small segment of the general public for only a short period during the transport of waste through the Paducah Site. Overall, air quality impacts associated with on-site waste activities under the Proposed Action would be negligible, localized, and temporary.

4.1.1.2 Radiation and chemical risk impacts

In order to estimate dose consequences or risk impacts to individuals, including workers and members of the general population, external radiation dose data is analyzed. Dose is presented in this EA in units of roentgen equivalent man (rem). The rem is the common unit of external dose rate. The appropriate unit of collective dose is person-rem (p-rem), which is a measure of the total radiation dose of a population. It represents the product of the average dose per person multiplied by the number of people exposed.

Dose impacts are converted to potential health risks by calculating the LCFs that may be associated with specific doses. Any increment of radiation dose is assumed to carry an associated risk of an LCF. Additionally, these health risks are termed latent because, typically, the potential cancer would occur approximately 10 to 30 years after the radiation exposure.

Rem—A unit of radiation dose used to measure the biological effects of different types of radiation on humans. The dose in rem is estimated by a formula that accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem.

Person-rem—A unit of collective radiation dose applied to a population or group of individuals. It is calculated as the sum of the estimated doses, in rem, received by each individual of the specified population. For example, if 1,000 people each received a dose of 1 millirem, the collective dose would be 1 p-rem (1,000 persons × 0.001 rem).

Latent cancer fatalities (LCFs)—Deaths from cancer resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens. This EA focuses on LCFs as the primary means of evaluating health risk from radiation exposure. A risk factor of 6E-04 LCF per p-rem or rem is used, consistent with DOE guidance (DOE 2003b). The values reported for an LCF area (1) the increased risk of an MEI or other individual developing a fatal cancer, or (2) the number of LCFs projected to occur in an identified population. For a population, if the calculated LCF value is less than 0.5, no cancer fatalities would be anticipated.

The average person in the U.S. receives 0.62 rem or 6.2E-01 rem of radiation dose per year, mostly from natural background sources and medical exposures (NCRP 2009).[8] Doses at this level have not been demonstrated to cause LCFs in humans (NRC 2019). LCF impacts are less certain compared with accident deaths that are immediate, however, the analysis of dose consequences is performed using these values to determine reasonably foreseeable potential impacts from the Proposed Action.

The calculated MEI and collective doses are used to determine potential human health effects in terms of LCFs using risk estimates recommended by the Interagency Steering Committee on Radiation Standards (ISCORS). The LCF dose-conversion factor is 6.E-04 LCF per rem in this calculation. This risk factor accounts for the age and gender distribution in the U.S. population. The risk factor was applied to the individual dose and to the total collective population dose. Though dose calculations are performed with multiple digits of accuracy to reduce rounding errors, the risk factor established by ISCORS has an accuracy of only one significant figure; therefore, the LCF values are presented with one significant figure (ISCORS 2002).

The potential on-site radiation and chemical risk impacts from on-site waste activities that are part of the Proposed Action were analyzed. LLW and MLLW comprise the majority of the wastes (greater than 99%) in the Proposed Action. The 2002 EA analyzed the treatment and disposal of approximately 413,000 ft^3 of LLW and MLLW during a 10-year period. This update analyzes the treatment and disposal of

[8] Members of the public are exposed routinely to natural and man-made sources of ionizing radiation. Half of the radiation dose to a member of the public, about 310 mrem/year, is from natural sources of cosmic and terrestrial origin. The other half is from man-made sources, including diagnostic and therapeutic X-rays, tomography, and fluoroscopy; nuclear medicine; consumer products, such as cigarettes and smoke detectors; fallout from nuclear weapon tests; industrial, research, and educational applications; and effluents from nuclear facilities (FRNP 2020).

approximately 5,050,000 ft^3 of mostly LLW and MLLW[9] during a 12-year period beginning in FY 2020, which is more than 10 times greater than the waste volume analyzed in the previous EAs (DOE 2002a; DOE 2003a).

Appendix D presents the details of these analyses, which are focused on the bounding case of on-site waste treatment activities to represent the impacts from the on-site waste activities that are part of the Proposed Action. These impacts are summarized in the following subsections and in Table 11.

Table 11. Radiological Impacts from the Proposed Action On-Site Waste Activities

Risk Group	Annual Dose	Total LCFs for 12-Year Period
Involved Worker Population	2.1E+00 p-rem	1.E-02 (no cancer fatalities)
General Population	6.0E-03 p-rem	5.E-05 (no cancer fatalities)
Maximally Exposed Individual (MEI)	9.0E-07 rem	6.E-09 (no cancer fatalities)

rem = roentgen equivalent man
p-rem = person-roentgen equivalent man

The chemical impact to workers and to the general population from the on-site waste activities would be minimal as described in Section 4.1.1.2.4.

4.1.1.2.1 Radiation risk impacts to workers

The dose consequences to workers were estimated from the recent occupational radiation dose data for the Paducah Site. For 2017, the most recent year for which annual data are available, the DOE annual occupational radiation exposure report stated that 5.2E+00 p-rem of collective radiation dose was recorded by 113 workers at Paducah (DOE 2018a). This is an average of 4.6E-02 rem per year per exposed worker. No other workers received measurable radiation doses.

As described in Appendix D, the annual dose impact from waste management activities during the Proposed Action was calculated to be 2.1E+00 p-rem per year. To consider the potential magnitude of latent health effects to the involved worker population from a collective dose of 2.1E+00 p-rem per year, the LCF risk factor, 6.E-04 LCF per rem, was applied (ISCORS 2002). The result was 1.E-03 LCF/year to the worker population. For the duration of the project, the total risk was calculated to be 1.E-02 LCF, or no cancer fatalities to the worker population.

As stated in Section 3.2.1.2.3, to protect workers from impacts from radiological exposure, 10 *CFR* Part 835 imposes an individual dose limit of 5 rem per year. The estimated annual worker dose (4.6E-02 rem per year per exposed worker) is much smaller than the dose limit. In addition, workers are protected from workplace hazards through appropriate training, protective equipment, monitoring, materials substitution, and engineering and management controls to maintain radiation exposures ALARA.

Based on the average background radiation exposure of 6.2E-01 rem per year, the radiation dose from the on-site waste management activities for the involved workers was calculated to be 8% of the background dose to the average involved worker (NCRP 2009).

[9] Less than 1% of the total of 5,050,000 ft^3 of waste is nonradioactive RCRA waste.

4.1.1.2.2 Radiation risk impacts to the general population

For the general population, the annual dose impact from waste activities was calculated to be 6.0E-03 p-rem, and the total radiation risk was calculated to be 5.E-05 LCF, or no cancer fatalities to members of the general population near the Paducah Site, as described below and in Appendix D.

In order to bound the radiological impact to the general population, the maximum amount of waste that would undergo on-site treatment prior to off-site transport was assumed to be 24% of the total waste volume, which is an overestimation of the volume of waste that would be treated on-site. Discoveries or changes in waste classification guidelines could increase or decrease the fraction of waste that is processed on-site.

The 2018 Annual Site Environmental Report for the Paducah Site states that the estimated potential collective population dose from the Paducah Site (all relevant pathways) was 7.6E-01 p-rem per year (FRNP 2020). For all of the relevant pathways that could impact the MEI, airborne emissions from on-site activities dealing with generation and on-site transport and disposal of waste, decontamination and maintenance of contaminated equipment, and other site activities (activities similar to the Proposed Action) could create the highest impact. As shown in Appendix D, of this collective dose, 6.0E-04 p-rem or 0.08% of the collective population dose was attributed to air emissions from operations. If all of the collective population dose from air emissions in 2018 is assumed to result from on-site waste management activities, and if this dose increased by a factor of 10 as a result of the increased volume of waste disposition under the Proposed Action as compared to the previous EAs (DOE 2002a; DOE 2003a), the estimated potential annual collective population dose from the waste activities of the Proposed Action would be 6.0E-03 p-rem per year. The annual collective risk was calculated to be 4.E-06 LCF per year. As a result, the total radiation risk for 12 years was calculated to be 5.E-05 LCF or no cancer fatalities to members of the general population near the Paducah Site.

4.1.1.2.3 Radiation risk impacts to the maximally exposed individual

For the MEI, the annual dose impact from waste activities was calculated to be 9.0E-07 rem, and the total radiation risk was calculated to be 6.E-09 LCF, or no cancer fatalities, as described below and in Appendix D.

The estimated potential dose to the MEI from the Paducah Site (all relevant pathways) in 2018 was 5.1E-03 rem (FRNP 2020). For all of the relevant pathways that could impact the MEI, airborne emissions from on-site activities that deal with generation and on-site transport and disposal of waste, decontamination and maintenance of contaminated equipment, and other site activities (activities similar to the Proposed Action) could create the highest impact. Of this collective dose, 9.0E-08 rem was attributed to air emissions from operations. The Clean Air Act (Subpart H of 40 *CFR* 61) establishes that a DOE facility cannot exceed emissions that would cause any member of the public to receive an effective dose equivalent of 1.0E-2 rem per year. If all of the estimated potential dose to the MEI from air emissions is assumed to result from on-site waste management activities, the estimated dose to the MEI at the Paducah Site would be 9.0E-08 rem or 0.00009% of the regulatory limit as shown in Appendix D.

In addition, if this dose increased by a factor of 10 as a result of the increased volume of waste disposition under the Proposed Action as compared to the previous EAs (DOE 2002a; DOE 2003a), the estimated dose to the MEI from the waste treatment activities of the Proposed Action would be 9.0E-07 rem per year. The upper bound estimate of the MEI risk associated with on-site waste activities under the Proposed Action also was calculated in Appendix D to be 5.E-10 LCF per year. The total radiation risk to the MEI under the Proposed Action was calculated to be 6.E-09 total LCF or no cancer fatalities.

Assuming the average MEI receives 6.2E-01 rem of radiation dose each year from background sources (NCRP 2009) and the increment from waste activities at the Paducah Site amounts to 9.0E-07 rem, the total estimated radiation exposure to the MEI, including on-site waste activities, essentially would be equivalent to the background dose of 6.2E-01 rem per year.

4.1.1.2.4 Chemical risk impacts

The chemical impact to workers and to the nearby general population from the on-site waste activities would be minimal as described below.

In general, the LLW streams contain a mixture of radioactive isotopes and toxic metals. The chemical risk associated with toxic metals in LLW was evaluated in the 2002 EA (DOE 2002a), which remains applicable to the present Proposed Action. The current Occupational Safety and Health Administration Permissible exposure limit for chromium (Cr) metal is 1 mg Cr/m^3 averaged over eight hours. As shown in Appendix D, the toxic metal concentrations based on a Cr toxicity equivalence as presented in the 2002 EA are only 2% of current protection thresholds for workers; therefore, the chemical impact to workers would be minimal.

The chemical risk to the general population was not calculated in the previous assessment. Toxic metals at the Paducah Site typically would be found within the particulate emissions from the Proposed Action activities. All of the Proposed Action activities with the potential to emit particulates would utilize negative air machines with high efficiency particulate filters to reduce the potential of emissions. Toxic metals would not be emissions of concern for waste treatment activities. Because of controls employed, the chemical risk to the general population from the on-site waste activities would be minimal.

4.1.1.3 Accident and intentional destructive act impacts

As described in Section 3.2.1.3, two evaluated accident events at one of the permitted waste storage facilities, C-746-Q, were selected from the EPHA to support the analyses in this EA: a large loss of confinement (seismic natural phenomena) and a small loss of confinement (FRNP 2019b). Because the waste would be shipped off-site without being stored for an extended period of time, the accidents evaluated in the EPHA for the waste storage facilities would be overestimated for the Proposed Action because the inventories in the waste storage facilities were calculated at capacity in the EPHA. The radiological and chemical risk impacts from the two evaluated accidents are summarized in the following subsections and in Table 12.

Table 12. Radiological Impacts from Accidents and Intentional Destructive Acts

Risk Group	Radiological Risk		Chemical Risk
	Dose Per Accident	Total LCFs for the 12-Year Period	Exposure Per Accident
Large Loss of Confinement (Seismic Natural Phenomena)			
Involved Worker (at 3.0E+01 m)	2.5E+03 rem	1.E-02 (no cancer fatalities)	5.4E+02 mg/m^3
MEI (Spring Bayou Baptist Church)	1.0E+00 rem	6.E-06 (no cancer fatalities)	1.9E-01 mg/m^3
Population	7.9E+00 p-rem	5.E-05 (no cancer fatalities)	N/A*
Small Loss of Confinement			
Involved Worker (at 3.0E+01 m)	2.5E+02 rem	2.E-02 (no cancer fatalities)	5.4E+01mg/m^3
MEI (Spring Bayou Baptist Church)	1.0E-01 rem	7.E-06 (no cancer fatalities)	1.9E-02 mg/m^3

N/A = not applicable
rem = roentgen equivalent man
p-rem = person-roentgen equivalent man
* See Section 4.1.1.3.2.

4.1.1.3.1 Impacts from large loss of confinement accident at C-746-Q

As discussed in Section 3.2.1.3, the probability of a 7.5 magnitude earthquake occurring in the next 50 years is 3% to 4% (FRNP 2019b). This equates to an annual probability of the following:

$$\frac{4.\text{E-}02}{50 \text{ years}} = 8.\text{E-}04/\text{year}$$

Involved worker impacts from a radionuclide release under this accident scenario were assumed to be equivalent to the dose at 3.0E+01 m of 2.5E+03 rem from the EPHA (FRNP 2019b). Incorporating the annual probability of the accident, the calculated annual risk to the involved worker would be the following:

2.5E+03 rem × 8.E-04/year × 6.E-04 LCF/rem = 1.E-03 LCF/year

The total risk to the involved worker during the 12-year period of the Proposed Action was calculated as follows:

1.E-03 LCF/year × 12 years = 1.E-02 LCF for the entire 12-year period or no cancer fatalities

The MEI for the large loss of confinement is located at the closest off-site population location from C-746-Q, which is the Spring Bayou Baptist Church, located off of Woodville Road approximately 1 mile southwest of the site. The MEI would receive a 1.0E+00 rem equivalent dose from this accident. Incorporating the annual probability of the accident, the calculated annual risk to the MEI was would be the following:

1.0E+00 rem × 8.E-04/year × 6.E-04 LCF/rem = 5.E-07 LCF/year

The total risk to the MEI during the 12-year period of the Proposed Action was calculated as follows:

5.E-07 LCF/year × 12 years = 6.E-06 LCF for the entire 12-year period or no cancer fatalities

A similar accident scenario also was evaluated in the 2002 EA, which calculated a dose of 1.9E-04 rem to the MEI from an earthquake event that involved breaching drummed waste. Because the EPHA addresses all activities and materials on-site, the EPHA's calculated MEI dose is higher than the 2002 EA's calculated dose by a factor of 1.0E+00/1.9E-04 = 5.3E+03. The EPHA did not calculate a population dose; the 2002 EA calculated a population dose of 1.5E-03 p-rem (DOE 2002a). Applying the ratio of the MEI doses (5.3E+03 factor) to the 2002 EA population dose of 1.5E-03 p-rem results in an estimated population dose for an earthquake that involves all materials on-site as follows:

1.5E-03 p-rem × 5.3E+03 factor = 8.0E+00 p-rem

Incorporating the annual probability of the accident, the resulting annual population risk would be the following:

8.0E+00 p-rem × 8.E-04/year × 6.E-04 LCF/rem = 4.E-06 LCF/year

The total risk to the population during the 12-year period of the Proposed Action was calculated as follows:

4.E-06 LCF/year × 12 years = 5.E-05 LCF for the entire 12-year period or no cancer fatalities

As analyzed in the EPHA, this accident scenario also would include a chemical risk along with the radiological risk discussed above. The EPHA analysis determined that workers on-site within 3.0E+01 m would be exposed to a chemical risk due to UO_2F_2 of 5.4E+02 mg/m^3, which is greater than the protective action criteria [(PAC)-2] of 4.3E+00 mg/m^3.[10] However, due to controls, including PPE, and emergency response protective actions that would be implemented on-site in response to an accident, the chemical risk would not be expected to exceed the PAC for the involved worker and would be below the PAC for uninvolved workers that are at least 5.9E+02 m from the facility, which is within the Paducah Site boundary. The chemical risk would be confined to the workers on-site. The chemical risk to the closest MEI, Spring Bayou Baptist Church, is 1.9E-01 mg/m^3, which is 4% of the PAC.

4.1.1.3.2 Impacts from small loss of confinement at C-746-Q

As discussed in Section 3.2.1.3, the probability of a small loss of confinement accident occurring was estimated to be 1.E-02 per year based on the vehicle impact/mishandling frequency in the 2002 EA (DOE 2002a). Involved worker impacts from a radionuclide release under this accident scenario were assumed to be equivalent to the dose at 3.0E+01 m of 2.5E+02 rem from the EPHA (FRNP 2019b). Incorporating the annual probability of the accident, the calculated annual risk to the involved worker would be the following:

2.5E+02 rem × 1.E-02/year × 6.E-04 LCF/rem = 2.E-03 LCF/year

The total risk to the involved worker during the 12-year period of the Proposed Action was calculated as follows:

2.E-03 LCF/year × 12 years = 2.E-02 LCF for the entire 12-year period or no cancer fatalities

The MEI for the small loss of confinement is located at the closest off-site population location from C-746-Q, which is the Spring Bayou Baptist Church, located off of Woodville Road, approximately 1 mile to the southwest of the site. The MEI would receive a 1.0E-01 rem equivalent dose from this accident. Incorporating the annual probability of the accident, the calculated annual risk to the MEI would be the following:

1.0E-01 rem × 1.E-02/year × 6.E-04 LCF/rem = 6.E-07 LCF/year

The total risk to the MEI during the 12-year period of the Proposed Action was calculated as follows:

6.E-07 LCF/year × 12 years = 7.E-06 LCF for the entire 12-year period or no cancer fatalities

The EPHA did not calculate a population dose; however, a similar accident scenario was evaluated in the 2002 EA in which the population dose was calculated to be 2.6E-02 p-rem. Applying the ratio of the MEI dose calculated above to the MEI dose (1.0E-01 rem) from the 2002 EA (DOE 2002a), which is 1.0E-01/1.1E-04 = 9.1E+02, to the 2002 EA calculated population dose of 2.6E-02 p-rem, results in an estimated population dose for a small loss of confinement accident, such as vehicle impact/mishandling involving breaching of drummed waste as follows:

2.6E-02 p-rem × 9.1E+02 factor = 2.4E+01 p-rem

[10] Different chemicals on-site will have different PAC levels and different calculated risk, depending on the specific situation (for example, location, quantity of material, duration of release, etc.).

Incorporating the annual probability of the accident, the resulting annual population risk would be the following:

2.4E+01 p-rem × 1.0E-02/year × 6.0E-04 LCF/rem = 1.0E-04 LCF/year

The total risk to the population during the 12-year period of the Proposed Action was calculated as follows:

1.0E-04 LCF/year × 12 years = 1.0E-03 LCF for the entire 12-year period or no cancer fatalities

The EPHA analyzed a maximum release to determine the emergency condition severity and the resulting maximum concentrations at a given distance.

As analyzed in the EPHA, this accident scenario also would include a chemical risk along with the radiological risk discussed above. The EPHA analysis determined that workers on-site within 3.0E+01 m would be exposed to a chemical risk of 5.4E+01 mg/m^3, which is greater than the PAC-2 of 4.3E+00 mg/m^3. However, due to controls, including PPE, and emergency response protective actions that would be implemented on-site in response to an accident, the chemical risk would not be expected to exceed the PAC for the involved worker and would be below the PAC for uninvolved workers that are at least 1.5E+02 m from the facility. The chemical risk would be confined to workers on-site. The chemical exposure to the closest MEI, Spring Bayou Baptist Church, is 1.9E-02 mg/m^3 which is 0.4% of the PAC.

4.1.1.3.3 Industrial accident risk impacts

In the 2002 EA, the calculated risk of industrial accidents under the Proposed Action was 0.02 expected fatalities over the 10-year operating period (DOE 2002a). In the current Proposed Action, the adjustment for the longer 12-year operating period would be 1.2E+00 times greater than in the 2002 EA.

The overall industrial accident rate also would be expected to increase by a factor of 1.0E+01 due to the increased waste volume being handled under the Proposed Action, as compared to the previous EAs. The estimated overall potential industrial accident rate for the Proposed Action, therefore, adjusted for both time period and volume would be as follows:

2.E-02 total LCFs × 1.25+00 time factor × 1.0E+01 volume factor = 3.E-01 LCFs for the entire 12-year period or no fatalities

The Paducah Site, however, maintains a robust zero accident policy and strong industrial safety programs that maintain industrial accident risks well within regulatory norms. No fatalities attributable to industrial accidents would be expected during the period of the Proposed Action.

4.1.2 Off-Site Transportation-Related Impacts

The following subsections present the off-site transportation-related impacts of the Proposed Action. Potential on-site impacts of the Proposed Action were discussed in Section 4.1.1.

4.1.2.1 Air quality

Overall, air quality impacts associated with transportation activities would be negligible, localized, and temporary, as described below.

Appendix E presents analyses of the off-site impacts from the estimated number of truck shipments that would occur in the proposed 12-year activity period. If the truck shipments are spread evenly over the 12-year period, the shipments would proceed at an average of 2 shipments per week. All nonattainment

areas are associated with large metropolitan areas. Planned shipments of 2 per week on average would not discernibly increase the daily rate of truck traffic for these metropolitan areas.

Analysis was undertaken to determine the impact of the proposed shipments relative to the threshold emission levels in nonattainment areas described by EPA in its air conformity regulations [40 *CFR* 93.153(b)(1)]. The EPA general conformity rule (58 *FR* 63214, November 30, 1993) requires that federal agencies prepare a written conformity analysis and determination for proposed activities only in those cases where total emissions of an activity exceed the threshold emission levels. Where it can be demonstrated that emissions from a proposed new activity fall below the thresholds, these emissions are considered to be *de minimis* and require no formal analysis.

Criteria air pollutants were evaluated for the proposed routes based on the maximum road miles proposed to be traveled. CO, ozone, and PM_{10} were the criteria pollutants used. The maximum road miles traveled through a nonattainment area would be approximately 200 miles (includes return trip) through the Dallas-Fort Worth, TX, area (Atlanta and St. Louis areas are nearly as large). This distance conservatively includes a return truck trip.

The EPA threshold for CO for all nonattainment and maintenance areas is 200,000 lb (100 tons) per year for any new proposed activity. The EPA threshold for ozone [measured by its precursor, nitrogen oxide (NOx)], for "ozone attainment areas outside an ozone transport region," such as Dallas-Fort Worth, is 200,000 lb (100 tons) per year. The EPA threshold for PM_{10} for all moderate nonattainment areas is 200,000 lb (100 tons) per year for any new proposed activity. Emission factors for CO, NOx, and PM_{10} have been calculated using the *Air Emissions Guide for Air Force Mobile Sources,* Table 5-23 (AFCEC 2017) for each criteria pollutant. Each year, as vehicles become more fuel efficient, gram per vehicle mile emission factors decrease. To conservatively estimate potential emissions, emission factors for 2019 were assigned. Heavy-duty, diesel-powered vehicles are defined as all larger diesel-powered motor vehicles designated primarily for the transportation of property and rated at more than 10,001 lb of gross vehicle weight. For heavy-duty, diesel-powered vehicles, including the standard commercial semi-tractor vehicles that would be used for pulling waste shipments, the average emission for CO is estimated as 1.768 grams per mile, while the NOx, (an ozone precursor) emission rate is 4.936 grams per mile. Finally, the emission factor for PM_{10} is 0.189 gram per mile.

A total of 1,234 shipments (truck round trips), 1,060 from the LLW and MLLW shipments and 174 trips for the nonradioactive R-114, was estimated for the 12-year evaluation period. The CO emission rate was estimated for the maximum distance traveled through a nonattainment area (Dallas-Fort Worth). This emission rate was approximately 0.5 tons of CO for the entire 12-year period. This would equate to approximately 4.0E-02 ton (80 lb) per year. This amount of emissions is below the threshold standard of 100 tons per year and is a *de minimis* amount.

Using the same 1,234 shipments for the 12-year evaluation period, an ozone emission rate was established for the maximum distance traveled within a nonattainment area (Dallas-Fort Worth area). This emission rate was approximately 1.3 tons of NOx for the entire 12-year period (NOx is a precursor to ozone). This would equate to approximately 0.1 ton (224 lb) per year. This amount of emissions is below the threshold standard of 100 tons/year and is a *de minimis* amount.

Finally, using the same 1,234 shipments for the 12-year evaluation period, an emission rate for particulate matter was established for the maximum distance traveled within a nonattainment area (Dallas-Fort Worth area). This emission rate was approximately 5.0E-02 ton of PM_{10} for the entire 12-year period. This would equate to approximately 4.0E-03 ton (8 lb) per year. This amount is below the threshold standard of 100 tons per year and is a *de minimis* amount.

Because the Dallas-Fort Worth area example maximizes road miles traveled through a nonattainment area and also conservatively estimates emission factors this example "bounds" the impacts within other nonattainment areas for the Proposed Action. Air emissions within nonattainment areas along shipment routes are well below the EPA threshold emission levels, thereby requiring no formal conformity analysis. Overall, air quality impacts associated with transportation activities would be negligible, localized, and temporary.

4.1.2.2 Radiation and chemical risk impacts from off-site transportation

This section discusses potential radiation and chemical risk impacts associated with transporting the LLW, MLLW, and radioactive R-114 to off-site treatment and disposal facilities in DOT- and RCRA-compliant shipping configurations. Details of the analysis are provided in Appendix E. The total waste volume with a radioactive component included in this transportation risk impacts analysis is 5,059,000 ft^3, which is the total waste volume from Table 2, including the nonradioactive RCRA hazardous waste, and the 9,000 ft^3 of excess R-114 which was assumed to be above authorized release limits and, therefore, LLW. The approximately 33,000 ft^3 of nonradioactive RCRA hazardous waste may contain background levels of radioactivity and are included in the calculation of dose to transportation workers and off-site populations to be protective of worker and public health and safety.

The data and analyses in previous NEPA evaluations (DOE 2002a; DOE 1997a) were reviewed and used to establish dose factors for the transport of LLW and MLLW by truck and rail. Consistent with the analyses in the WM PEIS (DOE 1997a), each truck was assumed to carry 44,000 lb of waste, and each railcar was assumed to carry 120,000 lb of waste. All of the LLW, MLLW, and radioactive R-114 material were assumed shipped by truck to Mercury, Nevada, and the same amount of waste was assumed shipped by rail to Richland, Washington, to ensure that the resulting calculated impacts are bounded and protective of the public health and safety. Generally, crew and population impacts are proportional to the distance waste is shipped, so use of closer disposition sites would result in relatively smaller doses. The MEI dose would remain the same regardless of the distance, but is proportional to the number of shipments. The consequence of possible accidents would remain the same, but the probability of accidents occurring would decrease with shipping distance.

The radiological risk impacts from truck and rail transportation in the Proposed Action are summarized in Tables 13 and 14, respectively.

4.1.2.2.1 Radiological impacts from truck transportation

The potential radiological effects of routinely transporting LLW, MLLW, and radioactive R-114 by truck from the Paducah Site to Mercury, NV, were estimated based on the methodology presented in previous NEPA evaluations and are detailed in Appendix E (DOE 2002a; DOE 1997a). The total truck shipments were evaluated for the probability of an LCF to the truck crew, the general population, and the MEI. The crew dose was calculated to be 2.9E+02 p-rem The general population dose of 3.5E+02 p-rem included people residing near the truck route and truck stop and people who travel along the truck shipment routes. The general population could also be exposed in the case of an accident and subsequent breached container. The risk, accounting for both the consequence of release and the probability of release scenarios, would be approximately 1.2E+01. The dose to the MEI was calculated to be 9.6E-04 rem. The radioactive wastes that would be shipped from the Paducah Site have relatively low radiological toxicity, and the probability of an accident is low. Additionally, the radiological risks from breached containers in traffic accidents are small compared with vehicle-related impacts (DOE 1997a; DOE 2002a).

Table 13 presents the radiological impacts for truck shipments.

Table 13. Radiological Impacts from Truck Shipments

Risk Group	Total for 12-Year Period	
	Dose	Total LCF
Crew	2.9E+02 p-rem	2.E-01 (no cancer fatalities)
Population—routine	3.5E+02 p-rem	2.E-01 (no cancer fatalities)
Population—accident	1.2E+01 p-rem	
MEI	9.6E-04 rem	6.E-07 (no cancer fatalities)

rem = roentgen equivalent man
p-rem = person-roentgen equivalent man

Members of the general population are assumed to be individuals who reside near the truck routes or travel over the same highway links. Members of the general population are exposed briefly during each shipment. The population risk also takes into account the possibility of an accident and a breach of the shipment containers. The total population LCF risk during the 12-year period was calculated to be 2.E-01 LCF. Thus for the Proposed Action, no LCF or cancer fatalities would be expected. The calculated doses and LCFs to the truck crews and the MEI would be lower than the doses and LCFs to the general population.

The dose to the MEI, as discussed in Appendix E, was calculated using the inverse square law, which is conservative and protective of public health and safety. The MEI dose for the 12-year period was calculated to be 9.6E-04 rem. The corresponding LCF risk was calculated to be 6.E-07 LCF or no cancer fatalities.

4.1.2.2.2 Radiological impacts from rail transportation

The potential radiological effects of routinely transporting LLW, MLLW, and radioactive R-114 by rail from the Paducah Site to Richland, WA, were estimated based on methodology presented in previous transportation analyses that are detailed in Appendix E (DOE 1997a). Rail shipments to Richland, WA, were evaluated for the probability of an LCF to the train crew, the general population, and the MEI.

Table 14 presents the radiological impacts for rail shipments.

Table 14. Radiological Impacts from Rail Shipments

Risk Group	Total for 12-Year Period	
	Dose	Total LCFs
Crew	1.4E+01 p-rem	8.E-03 (no cancer fatalities)
Population—Routine	3.9E+01 p-rem	2.E-02 (no cancer fatalities)
Population—Accident	2.3E+00 p-rem	
MEI	2.5E-03 rem	1.E-06 (no cancer fatalities)

The calculated collective dose to the rail crews, assuming a crew of five workers, would be 1.4E+01 p-rem. The most likely outcome would be that no LCF would be incurred by the workers (8.E-03 LCF).

The members of the general population are assumed to be individuals who reside near the train routes or who travel on trains over the same rail links. The members of the general population are exposed briefly during each shipment. The LCF to the general population also assumes the same people are going to be exposed during an accident, which is discussed in further detail in Appendix D. The total LCF for the 12-year period was calculated to be 2.E-2 or no cancer fatalities. Thus, for the Proposed Action, there would be no incidence of an LCF expected in the general population.

The dose to the MEI, as discussed in Appendix E, was calculated using the inverse square law, which is conservative and protective of public health and safety because the shielding effect of intervening railcars was not considered. The MEI dose for the 12-year period was calculated to be 2.5E-03 rem. The corresponding LCF risk was calculated to be 1.E-06 or no cancer fatalities.

4.1.2.3 Accident and intentional destructive act impacts from off-site transportation

Truck (or highway) and railroad accidents involving the off-site shipments of waste also were analyzed. Details of the analysis are provided in Appendix E and are summarized in Sections 4.1.2.3.1 and 4.1.2.3.2. Intentional destructive acts involving truck and rail shipments would not be expected to result in consequences that differ from the analyzed highway and railroad accidents. In the off-site transportation scenarios, the radionuclide inventory is bounded by the contents of individual waste packages. The impacts of intentional destructive acts, therefore, would be similar to a high-consequence transportation accident. The estimated maximum total highway safety impact would be 0.2 highway deaths and 4.6 injuries during the 12-year period of the Proposed Action, and the estimated maximum total railroad safety impact of the Proposed Action would be 0.2 deaths and 1.0 injuries during the 12-year period, as described below.

4.1.2.3.1 Impacts from highway accidents

The National Highway Traffic Safety Administration reported that, in 2016, 4,251 large trucks were involved in accidents that resulted in 4,369 fatalities in the U.S., which is a rate of 1.0278 fatalities per accident. During 2016, large trucks traveled 287,895 million miles on U.S. highways. The overall fatality rate was 1.52E-02 fatalities per million miles driven (NHTSA 2019). The identified waste streams and destinations would result in an estimated 5.2 million miles driven by trucks during the 12-year period of the Proposed Action. Because the site uses sole-use trucks, the assumption was made that the truck drivers back haul as empty shipments and the total number of miles driven to dispose of the wastes and return to the Paducah Site would be 10.4 million miles.

In addition, this EA assumes that the 7,650,000 lb of excess R-114 that is within DOE's authorized release limits (that is, not LLW) would be shipped to off-site locations for disposition as normal freight. Assuming a truckload limit of 44,000 lb, the disposition of this excess material would result in 0.3 million highway miles if the material were shipped to Mercury, NV. Because DOE owns the ISO containers that would be used to ship the material, the ISO containers would be returned to the Paducah Site. Back hauling the empty containers would result in another 0.3 million highway miles. This mileage estimate bounds the expected highway accident impact of these shipments to the off-site treatment and disposal sites. The total number of miles driven would be 11.0 million miles.

The estimated maximum number of traffic fatalities during the 12-year period would be as follows:

$$11.0 \text{ million miles} \times 1.52\text{E-}02 \text{ deaths/million miles} = 2.\text{E-}01 \text{ deaths}$$

These data are based on documented fatalities. For 2015, the last year for which full data are available, 116,000 injuries were related to 279,844 million miles driven by drivers of large trucks. The overall injury rate was 4.15E-01 injuries per million miles driven (NHTSA 2019). The estimated maximum number of injuries resulting from traffic accidents during the 12-year period would be as follows:

$$11.0 \text{ million miles} \times 4.15\text{E-}01 \text{ injury per million miles} = 4.6\text{E+}00 \text{ injuries}$$

As a result, the estimated maximum total highway safety impact of the Proposed Action would be 4.6E+00 injuries and 2.E-01 highway deaths during the 12-year period of the Proposed Action.

4.1.2.3.2 Impacts from railroad accidents

The Federal Railroad Administration Office of Safety Analysis reported that, in the 10-year period 2006 through 2015, an average of 745.587 million miles per year was traveled by trains in the U.S. (FRA 2019). During this period, an average of 4,412 rail accidents per year resulted in 281 deaths per year and 1,247 injuries per year. This data is based on documented fatalities and injuries attributed to accidents. Incidents other than rail accidents also contributed to deaths and injuries. The rail accident statistics associated with trains account for 37% of total fatalities and 14% of total injuries during this period.

The overall rail accident fatality rate was 3.77E-01 fatalities per million rail miles traveled. The identified waste streams and destinations result in an estimated 2.5 million railcar miles during the 12-year period. Because DOE owns the railcars containing the excess R-114, the empty railcars are assumed to be hauled back empty to the Paducah Site.

In addition, this EA assumes that the 7,650,000 lb of R-114 that is within DOE's authorized release limits (that is, not LLW) will be shipped to off-site locations for disposition. Assuming a railcar load limit of 120,000 lb, the disposition of R-114 will result in 64 railcars and 153,000 railcar miles (one-way) if the material is shipped to Richland, Washington. This mileage estimate bounds the expected railroad accident impact of these shipments to off-site treatment and disposal sites. The total number of railcar miles traveled would be 2.9 million miles.

The railcar loading yard at the Paducah Site can accommodate at least five railcars simultaneously. Assuming, that the railcars are shipped in five-car batches, the estimated maximum number of traffic fatalities resulting from rail accidents during the 12-year period would be as follows:

(2.9 million railcar miles/5 railcars per train) × 3.77E-01 deaths/million train miles = 2.E-01 deaths.

The overall injury rate was 1.67E+00 injuries per million miles driven. The estimated maximum number of injuries resulting from rail accidents during this 12-year period would be as follows:

(2.9 million railcar miles/5 railcars per train) × 1.67E+00 injuries/million miles = 1.0E+00 injuries.

As a result, the estimated maximum total railroad safety impact of the Proposed Action would be 2.E-01 deaths and 1.0E+00 injuries during the 12-year period.

4.2 IMPACTS OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, waste would not be transported off-site for treatment and/or disposal, and wastes generated during S&M activities would accumulate on-site. No new projects that would generate waste would be undertaken (that is, deactivation of facilities to prepare for decommissioning and disposition of excess R-114), but the probability of on-site radiation and chemical impacts would increase over time as the volume of on-site S&M waste requiring on-site storage increases. Regulatory repercussions would result over time because of the regulatory waste storage limitations (see Section 1.3). The No Action Alternative also would not meet the Portsmouth/Paducah Project Office mission to accelerate cleanup, eliminating potential environmental threats, reducing the DOE footprint, and reducing life-cycle cost.

4.2.1 On-Site Impacts

The following subsections present on-site impacts at the Paducah Site that result from the No Action Alternative. Potential off-site (that is, transportation-related) impacts are discussed in Section 4.2.2. Under

the No Action Alternative, on-site staging and storage of newly generated waste from S&M activities would occur; however, no on-site or off-site treatment or disposal would occur. Potential on-site impacts of implementation of the No Action Alternative are described in the following subsections.

4.2.1.1 Air quality

Overall, on-site air quality impacts would be expected to be less than from the Proposed Action and also would be localized and temporary, as described below.

In the No Action Alternative, DOE would not perform off-site treatment and disposal activities and continue only on-site waste storage and on-site disposal activities. No new projects that would generate waste would be undertaken. The on-site activities would include regular inspections of waste to ensure that container breaches which could release emissions into the air do not occur. The facilities and equipment would not change from the existing waste facilities and equipment. As discussed in Section 4.1.1.1, the primary air quality impacts would result from on-site transportation of wastes. Because the majority (76%) of the wastes in the Proposed Action would not be generated under the No Action Alternative, on-site air quality impacts would be expected to be less than from the Proposed Action and would also be localized and temporary.

4.2.1.2 Radiation and chemical risk impacts

The 3,813,000 ft^3 of LLW/MLLW large components outlined in Table 2 in Section 2.1 and the 93,000 ft^3 of excess R-114 that would be generated under the Proposed Action would not be generated under the No Action Alternative, although the radiological content would remain on-site within equipment, systems, and facilities; and the only wastes that would be generated would result from routine S&M activities (total of 1,237,000 ft^3). This represents an approximate 3-fold increase over the waste volume analyzed in previous EAs (DOE 2002a; DOE 2003a). On-site radiation risk impacts to workers and the population near the Paducah Site are described in the following subsections.

Under the No Action Alternative, the containers of waste would be inspected periodically to verify that they are intact, and, if required, containers would be repaired or the waste repackaged. These containers would be subject to the same conditions as the stored containers in the Proposed Action; however, they would be at risk for a longer period of time. The stored waste would require repackaging, as needed, and monitoring over the 100 year period. On-site treatment would be performed only on wastes that require some type of stabilization prior to long-term storage to render the waste safer for long-term storage. Chemical risk impacts would be expected to be similar to the Proposed Action because of the reduced volume of waste that would undergo on-site treatment prior to storage, which would be off-set by the larger volume of waste that would require storage on-site for the duration of the action.

These impacts are summarized in the following subsections and in Table 15.

Table 15. Radiological Impacts from the No Action Alternative On-Site Waste Activities

Risk Group	Annual Dose	Total LCFs for 100-Year Period
Involved Worker Population	5.2E+00 p-rem	3.E-01 (no cancer fatalities)
General Population	7.6E-01 p-rem	5.E-02 (no cancer fatalities)
Maximally Exposed Individual (MEI)	5.1E-03 rem	3.E-04 (no cancer fatalities)

rem = roentgen equivalent man
p-rem = person-roentgen equivalent man

The chemical impact to workers and to the general population from the on-site waste activities would be minimal as described in Section 4.2.1.2.4.

4.2.1.2.1 Radiation risk impacts to workers

For the involved worker population, the annual dose impact from the No Action Alternative was estimated to be 5.2E+00 p-rem/year, and the total radiation risk was calculated to be 3.E-01 LCF for the 100-year period or no cancer fatalities as described below and in Appendix D.

The dose consequences to workers were estimated from the recent occupational radiation dose data for the Paducah Site. For 2017, the most recent year for which annual data are available, the DOE annual occupational radiation exposure report stated that 5.2E+00 p-rem of collective radiation dose was recorded by 113 workers at Paducah (DOE 2018a). Because the radioactive material to be dispositioned during the Proposed Action currently is on-site within equipment, systems, and facilities, this entire collective occupational radiation dose for 2017 is assumed to be the annual collective dose to the involved worker population under the No Action Alternative, and this dose is assumed to continue for 100 years.

To consider the potential magnitude of latent health effects to the involved worker population from a collective dose of 5.2E+00 p-rem per year, the LCF risk factor, 6.E-04 LCF per rem, was applied (ISCORS 2002). The risk to the involved worker population was calculated to be 3.E-01 LCF for the 100-year period. For comparison to the Proposed Action 12-year period, the total risk for the No Action Alternative was calculated to be 4.E-02 LCF to the worker population. This impact is higher than the impact from the Proposed Action because more material would remain on-site for a longer period of time.

Workers are protected from workplace hazards through appropriate training, protective equipment, monitoring, materials substitution, and engineering and management controls to maintain radiation exposures ALARA. As stated in Section 3.2.1.2.3, to protect workers from impacts from radiological exposure, 10 *CFR* Part 835 imposes an individual dose limit of 5 rem per year.

The radiation dose from the on-site waste management activities for the involved workers under the No Action Alternative would be essentially the same as under the Proposed Action (that is, 8% of the background dose to the average involved worker).

4.2.1.2.2 Radiation risk impacts to the general population

For the general population, the annual dose impact from waste activities was calculated to be 7.6E-01 p-rem, and the total radiation risk was calculated to be 5.E-04 LCF, or no cancer fatalities to members of the general population near the Paducah Site, as described below and in Appendix D.

The 2018 Annual Site Environmental Report for the Paducah Site states that the estimated potential collective population dose from the Paducah Site (all relevant pathways) was 7.6E-01 p-rem per year (FRNP 2020). If the entire collective population dose in 2018 is assumed to result from on-site waste activities. The population risk associated with on-site waste activities under the No Action Alternative would be 5.E-04 LCF per year.

This annual collective population dose is assumed to continue for 100 years. As a result, the total radiation risk of the No Action Alternative to members of the general population near the Paducah Site would be 5.E-02 LCFs or no cancer fatalities.

4.2.1.2.3 Radiation risk impacts to the maximally exposed individual

For the MEI, the annual dose impact from waste activities was determined to be 5.1E-03 rem, and the total radiation risk was calculated to be 3.E-04 LCF or no cancer fatalities to the MEI, as described below and in Appendix D.

The estimated potential dose to the MEI from the Paducah Site (all relevant pathways) in 2018 was 5.1E-03 rem (FRNP 2020). This dose is 5% of the regulatory limit of 0.1 rem per year for a member of the public. Because the radioactive material to be dispositioned during the Proposed Action currently is on-site within equipment, systems, and facilities, the 2018 estimated potential dose to the MEI is assumed to be the annual dose to the MEI under the No Action Alternative, and this dose is assumed to continue for 100 years. The risk to the MEI associated with on-site waste activities was calculated to be 3.E-06 LCF per year. The total radiation risk was calculated to be 3.E-04 LCF, or no cancer fatalities to the MEI.

Assuming the average MEI receives 6.2E-01 rem of radiation dose each year from background sources (NCRP 2009) and the incremental potential dose to the MEI from on-site activities at the Paducah Site under the No Action Alternative is 5.1E-03 rem, the total estimated radiation exposure to the MEI, including on-site activities, would result in a negligible increase to the background dose of 6.2E-01 rem per year.

4.2.1.2.4 Chemical risk impacts

The chemical impact to workers and to the nearby general population from the on-site waste activities under the No Action Alternative would not be expected to be appreciably different from the Proposed Action and, therefore, would be minimal.

4.2.1.3 Accidents and intentional destructive acts

During the No Action Alternative, the packaged waste containers are assumed to be transported to an on-site location and stored for 100 years. The containers would be inspected periodically to verify that they are intact, and if required, then containers would be repaired or the waste repackaged. These containers would be subject to the same conditions as the stored containers in the Proposed Action; however, they would be at risk for a longer period of time. For the No Action Alternative, the 2002 EA calculated higher risks for the evaluation-basis earthquake scenario by a factor of 10 compared to the 2002 Proposed Action because of the longer period of risk; however, the risks for the vehicle impact accident remained the same because the lower, stored-waste activity levels of the No Action Alternative offset a longer risk period (DOE 2002a).

Industrial accident risk under the No Action Alternative would be expected to be similar to the Proposed Action because, although less total waste would be expected to be generated, the total volume of waste would remain on-site and require additional handling and repackaging. Assuming that the industrial accident risk would be the same as the Proposed Action and that the industrial accident risk would continue for 100 years or a factor of 1.0E+01 from the 2002 EA because the 2002 EA only covered 10 years, the calculated industrial accident risk would be as follows:

2.E-02 total LCFs × 1.0E+01 factor = 2.E-01 LCFs for the entire 100-year period or no fatalities

4.2.2 Off-Site Transportation-Related Impacts

Under the No Action Alternative, no waste would be transported off-site from the Paducah Site for treatment and/or disposal; therefore, no transportation-related impacts (such as, air quality, radiation and chemical risk impacts, accidents, and intentional destructive acts) would be associated with this alternative.

4.3 MITIGATION MEASURES

DOE will utilize mitigation measures in order to avoid, reduce, or eliminate potentially adverse environmental impacts associated with the on-site and off-site waste activities described in the Proposed Action. These mitigation measures include, but are not limited to, the following:

- Pollution prevention and waste minimization planning, including implementation of best management practices and reuse and recycle of waste and excess materials;

- Reuse of existing facilities wherever feasible rather than construction of new facilities;

- Training to ensure that workers understand operational procedures, pollution prevention and waste minimization plans, the impact on the environment, and alternatives to generation of LLW, MLLW, and hazardous wastes;

- Implementation of air quality control strategies to the extent practicable, including the use of alternatively fueled vehicles and equipment, reduction of vehicle and equipment idling time, and utilization of other emission controls applicable to waste management equipment;

- Implementation of transportation programs that are in compliance with applicable DOE Orders and DOT regulations to reduce transportation risk; and

- Rigorous quality assurance programs for the characterization of LLW, MLLW, and hazardous waste.

Additional mitigation measures may also be identified and implemented during the course of the Proposed Action under specific NEPA reviews.

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5. CUMULATIVE IMPACTS

Cumulative impacts are defined as "...the impact on the environment which results from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 *CFR* § 1508.7). Effects are considered cumulatively because significant effects may be the result of individual minor direct and indirect effects of multiple actions that occur over time. Cumulative effects should be considered over the "lifetime" of the effects, rather than the duration of the action.

This section describes past and present actions and reasonably foreseeable future actions that are considered pertinent to the analysis of cumulative impacts for this Proposed Action. Although not included in the waste projection volumes in this EA, CERCLA activities that generate waste are included in this section to evaluate cumulative impacts. Notably, uncertainty regarding scope and funding is associated with future CERCLA actions. Interim and final actions are contingent on additional CERCLA analysis.

5.1 PADUCAH SITE ACTIVITIES

The evaluation of cumulative impacts will focus on activities that will be carried out at the Paducah Site and activities carried out in the region surrounding the site. Site activities include those that are implemented as part of the DOE EM Program and other activities that are carried out as part of other site operations.

5.1.1 Environmental Management Program

The mission of the Portsmouth/Paducah Project Office is to conduct the safe, secure, compliant, and cost-effective environmental legacy cleanup of PGDP on behalf of the local communities and the American taxpayers. In addition to gaseous diffusion plant stabilization, deactivation, and infrastructure management, Portsmouth/Paducah Project Office's mission is to accomplish the following at the Paducah Site: environmental remediation; waste management; DUF_6 conversion; and decontamination and decommissioning. The DOE EM Program at the Paducah Site encompasses a range of activities, including the following: managing waste generated from deactivation of facilities and structures and other non-CERCLA activities at the site; conducting CERCLA activities; and disposing of solid waste containing residual radioactivity below DOE's authorized release limits in the on-site C-746-U Landfill. The cumulative impacts evaluation presented in Section 5.3 considers the impacts associated with the activities listed in Table 16.

Table 16. U.S. Department of Energy Environmental Management Activities at the Paducah Site

EM Activity	Scope	Status
Groundwater remediation	Operate and maintain existing groundwater remediation systems at the Paducah Site. This includes plume containment at the site. The pump-and-treat systems associated with the plume containment are being implemented under CERCLA.	This is ongoing and expected to continue into the future.
Soil remediation activities	Characterize and manage potentially contaminated soil and other media generated at the site. These activities are being conducted under CERCLA.	This is ongoing and expected to continue into the future.

Table 16. U.S. Department of Energy Environmental Management Activities at the Paducah Site (Continued)

EM Activity	Scope	Status
C-746-U Landfill operations	Transport and dispose of solid waste containing residual radioactivity below DOE's authorized release limits in the on-site landfill. DOE issued a Finding of No Significant Impact in 2002 for DOE/EA-1414 establishing the authorized release limits process for waste acceptance at the C-746-U Landfill (DOE 2002b).	This is ongoing and expected to continue into the future.
Uranium material management	Store, inspect, and manage existing uranium material.	This is ongoing and expected to continue into the future.
Deactivation of existing facilities	Characterize, decontaminate, and deactivate to prepare existing site facilities for future decommissioning and demolition. Deactivation activities at the site generate the majority of the waste addressed in this EA.	Limited actions are ongoing at this time (for example, small trailers and structures), but additional activities are planned in the future.
S&M of existing facilities	Inspect and maintain existing facilities at the site until future decommissioning and demolition.	This is ongoing and expected to continue into the future.
Storage and treatment of on-site deactivation waste	Store, inspect, and manage deactivation waste generated on-site. These activities are analyzed in this EA.	This is ongoing and expected to continue into the future.
Off-site waste treatment and disposal	Package and transport waste to off-site locations for treatment and/or disposal. These activities are analyzed in this EA.	This is ongoing, and scope will increase in the future.
Facilities decommissioning and demolition	Demolish site facilities and dispose of waste generated.	Limited actions are ongoing at this time (for example, small trailers and structures), but additional activities are being considered in the future.
CERCLA Remedial and Removal Actions	C-400; Southwest Plume Sources—SWMU 211-A; Burial Grounds—SWMU 4; and removal actions associated with C-400 in support of EM mission.	These actions are ongoing and are expected to continue into the future.
Disposal of low-level radioactive waste from remediation (that is, CERCLA activities) in an on-site disposal facility (the On-Site Waste Disposal Facility)	Construct an on-site disposal facility to accept LLW, MLLW, RCRA waste, and TSCA waste generated from remediation activities at the site.	This is not being evaluated at this time, but may be considered in the future.

5.1.2 Other Activities at Paducah

In addition to the EM Program that will be implemented at the Paducah Site, other activities will occur at the site to continue the mission of DOE and ensure the site remains in a safe condition for the workforce. Table 17 lists activities that are either ongoing at the Paducah Site or planned for the future, and Section 5.3 evaluates their cumulative impacts.

Table 17. Other U.S. Department of Energy Activities at the Paducah Site

Other Paducah Site Activity	Scope	Status
Land and facility transfers	Transfer individual facilities or land to reduce the Paducah Site footprint. DOE has completed a separate EA and issued a Finding of No Significant Impact in December 2015 to address future land transfers at Paducah, DOE EA-1927 (DOE 2015).	This activity is ongoing and expected to continue into the future.
Uranium DUF_6- to-DU-oxide conversion	Store and manage cylinders containing DU oxide conversion product, and operate the DUF_6-to-DU oxide conversion facility. This activity, including associated LLW, MLLW, and hazardous waste generation and off-site disposition, was evaluated in EIS-0359 (DOE 2004) and supplemental environmental impact statement, DOE/EIS-0359-S1/DOE/EIS-0360-S1 (DOE 2020).	This activity is ongoing and expected to continue into the future.
Maintenance of site infrastructure	Manage site infrastructure, including facilities and roadways, and mow and perform other activities to ensure workforce safety.	This activity is ongoing and expected to continue into the future.
Security complex construction	Construct new security complex to support training and certification of site security forces.	This activity is planned in the future.
C-531 switchyard bypass	Encompass directional borings to install underground feeders from a new 161-kilovolt substation; TVA is designing and constructing and will operate the substation for DOE; work is projected to start summer 2019.	This activity is ongoing and expected to continue in the future.
Construction of C-304 annex	Construct new facility annex, which currently is being evaluated and projected to start in FY 2020.	This activity is projected to start in FY 2020.
C-400 Complex Remedial Investigation/Feasibility Study project	Conduct Remedial Investigation/Feasibility Study activities at C-400.	This activity is ongoing and expected to continue in the future.
New hydrogen facility for DUF_6 facility	Construct new hydrogen facility for the DUF_6 project south of C-810 (C-100 parking lot) and north of the DUF_6 facility; construction is projected to start in FY 2020.	This activity is projected to start in FY 2020.
Conversion of additional commercially generated DUF_6	Section 3113(a) of the USEC Privatization Act [42 U.S.C. §§ 2297h-11(a)] and Section 66 of the Atomic Energy Act of 1954 (as amended), require DOE to accept commercial DUF_6 that has been determined to be LLW, for disposal upon request and reimbursement of cost by any generator licensed by NRC to operate a uranium enrichment facility. For purposes of evaluating the cumulative impacts, receipt and conversion of the entire mass of commercial DUF_6 (150,000 metric tons) is assumed (DOE 2020).	The activity is planned in the future.
Construction of a laser enrichment facility	GE-Hitachi Global Laser Enrichment is evaluating construction of a commercial laser enrichment facility, Paducah Laser Enrichment Facility, adjacent to the Paducah Site that they will finance, construct, own, and operate (DOE 2020). The construction and operation of the billion-dollar facility could bring approximately 800 to 1,200 jobs to the local community. Impacts would not be expected to exceed the impacts of historic operations at the Paducah Site (DOE 2020).	The activity is planned in the future.

5.2 OTHER REGIONAL ACTIVITIES

In addition to the activities at the Paducah Site, the cumulative impacts associated with activities carried out by other organizations in the region surrounding the site are considered. Table 18 outlines regional activities that will be included in the cumulative impact evaluation, and Section 5.3 considers their impacts.

Table 18. Regional Activities

Regional Activity	Scope	Status
New industrial park in the ROI	Continue preliminary discussions and planning; no location has been selected at this time.	Planning is underway for future development.
TVA Shawnee Fossil Plant	Continue to operate the nine-unit coal-fired generating plant that borders the Paducah Site to the north and close 200 acres of special waste landfill.	This activity is ongoing and expected to continue into the future.
Joppa Power Plant	Continue to operate the six-unit coal-fired generating plant and two gas turbines located approximately 4.5 miles northwest of the Paducah Site in Joppa, IL.	This activity is ongoing and expected to continue into the future.
Honeywell Metropolis Works	Conversion of uranium ore into UF_6.	The facility currently is idled while maintaining minimal capacity to restart operations, should future demand increase.
Ohio River Triple Rail Megasite	Develop a 1,112-acre undeveloped site for a rail spur and barge dock that would be used for industrial and commercial uses. The site is located northeast of the Paducah Site, adjacent to the TVA Shawnee Fossil Plant.	Planning is underway for future development.
Phoenix Paper	The paper mill in Wickliffe, KY, reopened in May 2019 approximately 25 miles southwest of the Paducah Site with announcements in August 2019 of a recycling facility being added onto the facility within the next 18 months.	Planning is underway for recycling facility with completion projected in February 2021.

5.3 CUMULATIVE IMPACTS

Cumulative transportation impacts in the region surrounding the Paducah Site could occur from increased development and growth. No transportation impacts from implementing the Proposed Action are anticipated; no upgrades to existing transportation systems or new construction of roads or rail facilities would be necessary, although one of the future regional projects would result in construction of new rail and barge facilities in the area. No additional utility resources are required for implementing the Proposed Action. Existing utilities are considered sufficient for the actions in the Paducah Site area, based on the available information. Potential cumulative impacts that could occur from the Proposed Action for the Paducah Site and the other regional activities are presented in the following subsections.

The cumulative impacts analysis does not address cumulative impacts separately that are specific to the No Action Alternative because DOE determined that the types of potential cumulative impacts related to this alternative would be the same as or lower than those associated with the Proposed Action. Because the alternatives analyzed in this EA would produce negligible impacts on the resource subject areas listed in Table 5, the alternatives would not substantially contribute to cumulative impacts.

5.3.1 On-Site Activities

5.3.1.1 Air quality

As described below, the cumulative impacts of the Proposed Action, coupled with air emissions from the Shawnee Fossil Plant and other emission sources in the region, would result in negligible impacts on the region's air quality.

The Proposed Action, in combination with the other area actions, is unlikely to have major impacts on local or regional air quality. Current air quality is in attainment in the Paducah area. The area is designated as a Class II PSD area. New emission sources are not permitted to degrade air quality above the applicable limits, defined in terms of maximum ambient air increments established for a Class II area (401 *KAR* Section 51:017). Air emissions from the other activities in the region, such as stationary sources, would be subject to engineering controls and would be required to adhere to applicable regulations and permits. The TVA Shawnee Fossil Plant was a major contributor to criteria air pollutants in McCracken County during 2008, but the plant has taken several steps to reduce its emissions. TVA recently has installed scrubbers and selective catalytic reduction systems at two of the Shawnee Fossil Plant's units to control emissions. These systems are expected to reduce emissions of NOx and SO_2 by approximately 22%. The cumulative impacts of the Proposed Action, coupled with air emissions from the Shawnee Fossil Plant and other emission sources in the region, would result in negligible impacts on the region's air quality.

5.3.1.2 Radiation and chemical risk impacts

DOE has evaluated the dose and LCF from sitewide activities at the Paducah Site. Even with the slight increase in radiation dose and LCF projected from the Proposed Action (see Section 4.1.1.2), the radiation dose is within allowable limits and there would be no cancer fatalities. The radiation and chemical risk impacts to the nearby population are minimal. There would be a minimal increase in risks associated with the involved workers at the Paducah Site due to the increased volume of waste handled. These risks are isolated and would not pose any cumulative impacts with nearby or future planned activities. In addition, removal of the waste from the Paducah Site generally would have a more favorable impact on radiation and chemical risks to the worker and nearby population than the No Action Alternative.

5.3.1.3 Accidents and intentional destructive acts

The Proposed Action, in combination with the other area actions, is unlikely to have major impacts on local or regional radiation dose due to an accident or intentional destructive act. The large loss of confinement accident would be an earthquake, which also would affect other local and regional projects and facilities. The cumulative impacts from the Proposed Action at the Paducah Site would be negligible compared to the earthquake impact throughout the area. Portions or all of the radiological and chemical hazards at the Paducah Site and off-site industrial facilities could be released as a result of an earthquake. Buildings and structures throughout the surrounding area could sustain damage and potentially collapse or rupture. Public utility systems, electric, gas, water, and sewer, throughout the area, as well as those at the Paducah Site, could be damaged. Fires and explosions could result from ruptured structures and utility systems. The large and small loss-of-confinement accidents are reasonably foreseeable accidents expected to result in exposures to the workers on-site and to the populations surrounding the plant. The impacts from the release after earthquake incident would lessen with distance from the Paducah Site; the MEI located at the Spring Bayou Baptist Church would receive a dose of 1.0E+00 rem, equating to a 6.E-06 LCF or no cancer fatalities for the entire 12-year period as a result of the large loss of confinement incident. The impacts to the general population from the Proposed Action large loss of confinement incident would be 7.9E+00 p-rem, equating to 5.E-05 LCF for the entire 12-year period or no cancer fatalities. These LCFs to the MEI and general population for the period are negligible. As the radiological and chemical inventory

from wastes and materials at the Paducah Site decreases during the Proposed Action, the risk from accidents involving loss of confinement also decreases.

The analyzed accidents have the potential for recurrence. The possibility of cumulative risks from the Proposed Action occurs if workers or members of the public are exposed to accidental radioactivity releases from multiple events. If a large loss of confinement accident occurred, the Paducah Site would suspend the generation of additional stored waste until the backlog of stored waste was shipped to treatment or disposal sites, and the contaminated storage facility could be remediated or demolished. This action would remove the source term for future earthquake events and prevent cumulative impacts to the workers and the public.

If a small loss of confinement accident occurred, the Paducah Site would suspend further generation of wastes until the contaminated storage facility could be remediated or demolished. Although the use of vehicles cannot be eliminated, Paducah Site health and safety programs would implement corrective actions to mitigate the probability or severity of future incidents. Naturally, foreseeable accidents presently are mitigated by Paducah Site safety programs, and the Paducah Site maintains industry standard programs for continuous safety improvement and reduction of potential radiation doses.

The potential consequences for cumulative impacts under the No Action Alternative are increased by the increased waste volume, while the probability of the impacts is increased by the longer time period for the No Action Alternative. The No Action Alternative excludes the shipment of LLW or MLLW, which is the primary means of mitigation, for a period of 100 years. The potential risk of the large accident and the potential for multiple large accidents of this type is higher due to the extended period of storage and lack of inventory reduction.

5.3.1.4 Off-site transportation-related activities

Implementing the Proposed Action would result in a minor increase in vehicle traffic associated with the off-site waste shipment. Implementing the Proposed Action would not require any upgrades to existing transportation systems or new construction of roads or rail facilities. Peak-hour traffic volumes could increase slightly over current levels, and would depend on total employment numbers; however, the increase would be expected to be negligible. Air quality impacts from the planned shipments of two per week on average for the Proposed Action would not increase discernibly the daily rate of truck traffic for any metropolitan area, and the shipments would be minimal compared with the daily rate of truck traffic in the metropolitan areas.

Under the Proposed Action, radiological waste would be shipped to off-site facilities for treatment and disposal. The radiological effects of truck and rail shipments were presented in Section 4.1.2.2, and radiological risks associated with the Proposed Action were determined to be minimal.

The cumulative impact on the MEI in the area surrounding the Paducah Site was independently calculated for rail and truck transport by assuming that one individual was exposed to every truck shipment, and a different individual was exposed to every rail shipment. The MEI doses in this EA therefore are conservative, and cumulative effects to residents near the Paducah Site would be higher than the impacts stated above because the MEI is exposed to other types of waste and materials transported from the site, including CERCLA waste and DU oxide waste from the DUF_6 conversion process.

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APPENDIX A

LIST OF PREPARERS

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LIST OF PREPARERS

This environmental assessment (EA) was prepared by the U.S. Department of Energy (DOE). The following DOE individuals led the effort.

- Cynthia Zvonar, Portsmouth/Paducah Project Office (PPPO) NEPA Compliance Officer, DOE NEPA Document Manager

- Bill Ostrum, Environmental Protection Specialist, Acting DOE Environmental Management NEPA Compliance Officer

Much of the information and text in this EA was included in previous DOE assessments, including the 2002 EA for waste disposition activities at the Paducah Site (DOE 2002a).

Tables A.1 and A.2 present contract and consultant staff members who contributed to the preparation of the EA.

Table A.1. Four Rivers Nuclear Partnership, LLC

Name	Education/Expertise	Responsibility
Cheryl Baker	B.S., Chemical Engineering, Master of Business Administration Over 38 years of experience	Environmental Assessment Lead
Dave Hutchison	B.S., Industrial Technology Over 39 years of experience	Director, Environmental Services
Brian Bell	B.S., Environmental Engineering Technology Over 31 years of experience	Waste Management
James Miller	B.S., Business Management Over 31 years of experience	Director, Technical Services
Tim Fralix	Over 37 years of experience	Waste Transportation
Dhomynic Lightfoot	B.S., Occupational Safety and Health Over 25 years of experience	Facility Waste Operations

Table A.2. Jacobs Team

Name	Education/Expertise	Responsibility
Eric Woods	B.S., Biology/Environmental Science; M.S., Environmental Science; MBA, Organizational Leadership Over 25 years of experience	Senior Technical Consultant
Lyna Black	B.S., Biological Resources; M.S., Geosciences Over 25 years of experience	Environmental Assessment Lead
Rick Zeroka	B.S., Ecology; B.A., Physical Geography; M.A., Energy and Environmental Science Over 25 years of experience	Project Description, Cumulative Impacts, Water Resources, Ecological Resources-Lead
Arthur Desroiers	ScD, Radiation Protection; M.S., Nuclear Engineering; B.S., Physics Over 40 years of experience	Radiological/Transportation Risk-Lead
Adam Engel	B.S., Health Physics Over 3 years of experience	Radiological/Transportation Risk
Rich Reaves	Ph.D., Wetland and Wildlife Ecology; B.S., Health Physics Over 3 years of experience	Ecological Resources-Lead
Danielle Stanley	B.S., Wildlife Ecology and Resource Management Over 25 years of experience	Water Resources, Ecological Resources
Jon Schultis	B.A., Political Science; Master of Public Administration Over 10 years of experience	Land Use, Socioeconomics, Environmental Justice-Lead
Amy Favret	M.A., Anthropology; B.A., Anthropology and Geology; Master of Public Administration Over 20 years of experience	Cultural/Archaeological, Native American Resources-Lead
April Greenberg	M.A., Anthropology; B.A., Classical Civilizations Over 10 years of experience	Cultural/Archaeological, Native American Resources
Julie Petersen	B.S., Biology Over 10 years of experience	Geology/Seismicity, Soils and Prime Farmland, Water Resources/Water Quality
Stephanie McMackin	M.S., Civil Engineering Over 20 years of experience	Climate Change/Air Quality-Lead
Megan Karl	B.S., Biosystems Engineer Over 10 years of experience	Climate Change/Air Quality

Table A.2. Jacobs Team (Continued)

Name	Education/Expertise	Responsibility
Fawn Elhadidi	Certificate of Business, Management and Accounting Over 25 years of experience	Geographic Information Systems, Graphics-Lead
Austen Sandifer	M.A., Religion and Society (environmental rhetoric); B.A., English and Anthropology Over 15 years of experience	Editor-Lead
Lorae Klein	Over 10 years of experience	Editor
Jennifer Moore	M.T.S.C. Master of Technical and Scientific Communications B.S. English and journalism Over 24 years of experience	Editor
Sandra Frausto	B.A., English, Concentration in Writing Over 10 years of experience	Document Publisher-Lead
Carol Hullinger	Over 35 years of Experience	Document Publisher

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APPENDIX B

AGENCIES AND PERSONS CONTACTED

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This appendix includes the notification letters and emails (i.e., example form letters and emails) to host state governors, host state agencies, and host tribes, and the distribution list for receipt of the notifications.

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Department of Energy
Washington, DC 20585
March 11, 2020

The Honorable Doug Ducey
Governor of Arizona
1700 West Washington Street
Phoenix, Arizona 85007

Dear Governor Ducey:

This letter constitutes notification that the U.S. Department of Energy (DOE) intends to prepare an updated environmental assessment (EA) pursuant to the National Environmental Policy Act (NEPA) to analyze the potential environmental impacts associated with the management and disposition of waste and excess material at the Paducah Gaseous Diffusion Plant (Paducah).

The subject of the EA is the management and disposition of non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) waste and excess material that will be generated from deactivation and other non-CERCLA environmental management activities at Paducah over the next 12 years. The proposed action is to transport the waste from the Paducah Site in Kentucky for treatment and/or disposal at existing, off-site DOE and commercial treatment and disposal facilities across the United States.

DOE will provide you an opportunity to review and comment on the Draft EA once it is completed. Instructions on how to submit any comments you may have will be provided along with the Draft EA. For information on the proposed action and Draft EA, please contact Ms. Cynthia Zvonar at the DOE Portsmouth/Paducah Project Office, at (859) 219-4066 (cynthia.zvonar@pppo.gov). For general information on the DOE Office of Environmental Management (EM) NEPA process, please contact Mr. Bill Ostrum at the EM Office of Regulatory Compliance, at (202) 586-2513 (william.ostrum@hq.doe.gov).

If you have any questions, please contact me or Mr. Mark Planning, Deputy Assistant Secretary for Intergovernmental and External Affairs, Office of Congressional and Intergovernmental Affairs, at (202) 586-3600.

Sincerely,

Todd A. Shrader
Principal Deputy Assistant Secretary for
Environmental Management

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Department of Energy
Washington, DC 20585

March 11, 2020

Mr. Lee Andrews
Kentucky Field Office Supervisor
U.S. Fish and Wildlife Service
Kentucky Ecological Services Field Office
3761 Georgetown Road
Frankfort, Kentucky 40601

Dear Mr. Andrews:

This letter constitutes notification that the U.S. Department of Energy (DOE) intends to prepare an updated environmental assessment (EA) pursuant to the National Environmental Policy Act (NEPA) to analyze the potential environmental impacts associated with the management and disposition of waste and excess material at the Paducah Gaseous Diffusion Plant (Paducah).

The subject of the EA is the management and disposition of non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) waste and excess material that will be generated from deactivation and other non-CERCLA environmental management activities at Paducah over the next 12 years. The proposed action is to transport the waste from the Paducah Site in Kentucky for treatment and/or disposal at existing, off-site DOE and commercial treatment and disposal facilities across the United States.

DOE will provide you an opportunity to review and comment on the Draft EA once it is completed. Instructions on how to submit any comments you may have will be provided along with the Draft EA. For information on the proposed action and Draft EA, please contact Ms. Cynthia Zvonar at the DOE Portsmouth/Paducah Project Office, at (859) 219-4066 (cynthia.zvonar@pppo.gov). For general information on the DOE Office of Environmental Management (EM) NEPA process, please contact Mr. Bill Ostrum at the EM Office of Regulatory Compliance, at (202) 586-2513 (william.ostrum@hq.doe.gov).

If you have any questions, please contact me or Mr. Mark Planning, Deputy Assistant Secretary for Intergovernmental and External Affairs, Office of Congressional and Intergovernmental Affairs, at (202) 586-3600.

Sincerely,

Todd A. Shrader
Principal Deputy Assistant Secretary for
Environmental Management

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Department of Energy
Washington, DC 20585

March 11, 2020

Ms. Edwina Butler-Wolfe
Governor
Absentee-Shawnee Tribe of Indians of Oklahoma
2025 South Gordon Cooper Drive
Shawnee, Oklahoma 74801

Dear Governor Butler-Wolfe:

This letter constitutes notification that the U.S. Department of Energy (DOE) intends to prepare an updated environmental assessment (EA) pursuant to the National Environmental Policy Act (NEPA) to analyze the potential environmental impacts associated with the management and disposition of waste and excess material at the Paducah Gaseous Diffusion Plant (Paducah).

The subject of the EA is the management and disposition of non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) waste and excess material that will be generated from deactivation and other non-CERCLA environmental management activities at Paducah over the next 12 years. The proposed action is to transport the waste from the Paducah Site in Kentucky for treatment and/or disposal at existing, off-site DOE and commercial treatment and disposal facilities across the United States.

DOE NEPA regulations require that DOE "notify the…host tribe of a DOE determination to prepare an EA" (10 CFR § 1021.301(c)) and that "DOE shall provide the…host tribe with an opportunity to review and comment on any DOE EA prior to DOE approval of the EA" (10 CFR § 1021.301(d)). DOE is providing this notification to Indian tribes with tribal lands within which DOE is proposing this action, including a portion of a preliminary transportation route.

DOE will provide an opportunity to review and comment on the draft EA to "American Indian tribe(s) within whose tribal lands DOE proposes an action" (10 CFR § 1021.104(b), and as required by 10 CFR § 1021.301(d), once it is completed. Instructions on how to submit any comments you may have will be provided along with the Draft EA. For information on the proposed action and Draft EA, please contact Ms. Cynthia Zvonar at the DOE Portsmouth/Paducah Project Office, at (859) 219-4066 (cynthia.zvonar@pppo.gov). For general information on the DOE Office of Environmental Management (EM) NEPA process, please contact Mr. Bill Ostrum at the EM Office of Regulatory Compliance, at (202) 586-2513 (william.ostrum@hq.doe.gov).

If you have any questions, please contact me or Mr. Mark Planning, Deputy Assistant Secretary for Intergovernmental and External Affairs, Office of Congressional and Intergovernmental Affairs, at (202) 586-3600.

Sincerely,

Todd A. Shrader
Principal Deputy Assistant Secretary for
Environmental Management

From: Paducah EA Comments
Sent: Monday, April 20, 2020 11:06 AM
Subject: Draft Paducah Gaseous Diffusion Plant Environmental Assessment (EA) for Proposed Disposition of Waste and Materials (DOE/EA-2116) for review

The Department of Energy's Office of Environmental Management has prepared the *Draft Paducah Gaseous Diffusion Plant Environmental Assessment (EA) for Proposed Disposition of Waste and Materials (DOE/EA-2116)*. DOE NEPA regulations require that DOE "notify the host state and host tribe of a DOE determination to prepare an EA" (10 CFR § 1021.301(c), see letter dated March 11, 2020) and that "DOE shall provide the…host tribe with an opportunity to review and comment on any DOE EA prior to DOE approval of the EA" (10 CFR § 1021.301(d)). DOE is providing this draft EA to states and Indian Tribes with land within which DOE is proposing this action, including a portion of the preliminary transportation route. The document can be found at **http://fourriversnuclearpartnership.com/distribution/DraftEA_DOE-EA-2116.pdf**.

Please email comments to PaducahEAComments@pad.pppo.gov by the close of business on Thursday, May 14, 2020**.**

For information on the Draft EA or the DOE Office of Environmental Management (EM) NEPA process, please contact Mr. Bill Ostrum, EM NEPA Compliance Officer at the EM Office of Regulatory Compliance, at **PaducahEAComments@pad.pppo.gov**, or (202) 586-2513.

Thank you for your time.

Sincerely,
Bill Ostrum
EM NEPA Compliance Officer
Office of Environmental Management, EM-4.31
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
202-586-2513

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From:	Paducah EA Comments
Subject:	Extension of Comment Period - Draft Paducah Gaseous Diffusion Plant Environmental Assessment for Proposed Disposition of Waste and Materials
Date:	Thursday, May 14, 2020 2:00:55 PM

The Department of Energy is extending the review period for the *Draft Paducah Gaseous Diffusion Plant Environmental Assessment (EA) for Proposed Disposition of Waste and Materials (DOE/EA-2116)* after receiving an extension request. A 14-day review period that was to expire on May 14 is being extended to May 28, 2020 due to feedback from stakeholders.

The document can be found at http://fourriversnuclearpartnership.com/distribution/DraftEA_DOE-EA-2116.pdf. Please send comments to **PaducahEAComments@pad.pppo.gov**.

For information on the Draft EA or the DOE Office of Environmental Management (EM) NEPA process, please contact Mr. Bill Ostrum, EM NEPA Compliance Officer at the EM Office of Regulatory Compliance, at **PaducahEAComments@pad.pppo.gov**, or (202) 586-2513.

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APPENDIX C

WILDLIFE SPECIES POTENTIALLY OCCURRING AT THE PADUCAH SITE

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C.1 INTRODUCTION

Wildlife species indigenous to hardwood forests, scrub-shrub, and open grassland communities are present at the Paducah Site. Both game and nongame species are attracted to the area because of the habitat management program implemented in the West Kentucky Wildlife Management Area (WKWMA) (CH2M HILL 1992). Aquatic species are present in both Bayou and Little Bayou Creeks at the Paducah Site and in the lagoons and ponds at the Paducah Site, including various ponds within WKWMA. However, suitable habitat for most wildlife and aquatic species present at the Paducah Site does not occur within the industrial core of the site where the on-site activities evaluated in this EA would occur.

KDFWR (Kentucky Department of Fish and Wildlife Resources) has identified 16 federally listed threatened or endangered species, including 3 mammal species, 1 fish species, 1 bird species, and 11 mussel species that may occur in the immediate vicinity of the Paducah Site as shown in Table C.1. (KDFWR 2019). The USFWS (U.S. Fish and Wildlife Service) recognizes only 15 threatened or endangered species as potentially occurring in the immediate vicinity of the Paducah Site, and no critical habitat has been identified at the site (USFWS 2019a). No species listed in the table are known to inhabit the industrial core of the site where the on-site activities evaluated in this EA would occur.

Animal species listed by the Commonwealth of Kentucky known to occur or with potential to occur in McCracken County are provided in Table C.2. Of the Commonwealth-listed birds identified for the area, only Bell's vireo historically has been observed on the Paducah Site (CH2M HILL 1992). Habitat for the Bachman's sparrow includes old-field habitat and disturbed grassland areas, which occur near the Paducah Site. No sightings of this species, however, have been verified near the Paducah Site (DOE 2002).

None of the listed mammals potentially occurring in the area have been observed on the Paducah Site, except the Indiana bat, which was observed in the WKWMA in 1999. The northern crawfish frog, a special concern species, occurs in the area defined by the Heath USGS (United States Geological Survey) 7.5-minute topographic quadrangle map, which contains the Paducah Site (KDFWR 2014a), but observation of this species has not been documented at the site. The lake chubsucker and the redspotted sunfish, both threatened species, have been observed in Bayou Creek, and the redspotted sunfish has been observed in Little Bayou Creek (CH2M HILL 1991). Because there are no listed species or critical habitat at the Paducah Site, there was no need or requirement for Section 7 consultation under the Endangered Species Act.

No Commonwealth or federally listed plant species are known to or are likely to occur within the industrial core of the Paducah Site because of historical disturbance from construction and regular grounds maintenance. Commonwealth-listed endangered plants that may occur in the area, as identified by the Office of Kentucky Nature Preserves, are listed in Table C.3. (KYNP 2018). No federally listed endangered plants were identified as occurring at the Paducah Site (USFWS 2019a).

No Commonwealth or national parks, forests, conservation areas, or scenic and/or wild rivers are located at or near the Paducah Site.

Table C.1. Federally Listed Species in or Near the Paducah Site

Group	Scientific Name	Common Name	Federal Status	Habitat Comments
Mammals	*Myotis sodalis*	Indiana bat	Endangered	Indiana bats winter in caves, but during their reproductive season from mid-May to mid-August, the bats form colonies in mature trees with loose bark or cavities. Shagbark hickory (*Carya ovata*), especially when near water, is a tree commonly used by the Indiana bat (CH2M HILL 1992). The Indiana bat occurs throughout the eastern United States, and maternity/reproductive colonies have been recorded in McCracken County (KDFWR 2014b). The KDFWR conducted a mist-net survey of the WKWMA during the summer of 1999. Five Indiana bats were captured during the survey (KDFWR 2000). Near the Paducah Site, some potential summer habitat for bat species exists on the DOE Reservation. Tree clearing should be avoided during time periods when the bat species may be using a tree habitat to roost to reduce impacts of the Proposed Action.
	Myotis septentrionalis	Northern long-eared bat	Threatened	The northern long-eared bat, a federally threatened species, occurs throughout eastern North America and is present year-round in Kentucky. The species is presumed to occur commonwealth-wide and it is recorded in McCracken County records. Similar to the Indiana bat, the long-eared bat hibernates in caves and roosts under loose tree bark from spring through fall. Northern long-eared bats also hibernate in rock shelters and abandoned mines. Females gather into maternity colonies under the bark of trees (KDFWR 2014c).
	Myotis grisescens	Gray bat	Endangered	The gray bat, a federally endangered species, occurs throughout the cave regions of Southern Appalachia, but no observations have been recorded from McCracken County. Gray bats are restricted to caves or cave-like habitats (KDFWR 2014d).
Fish	*Scaphirhynchus platorynchus**	Shovelnose sturgeon	Threatened	The shovelnose sturgeon, a federally threatened species, occurs in main channels of the Ohio and Mississippi Rivers (KDFWR 2011). The shovelnose sturgeon was not identified in species surveys of the Little Bayou or Bayou Creeks (CH2M HILL 1991; CH2M HILL 1992).

Table C.1. Federally Listed Species in or Near the Paducah Site (Continued)

Group	Scientific Name	Common Name	Federal Status	Habitat Comments
Birds	*Sternula antillarum athalassos*	Interior least tern	Endangered	The interior least tern, a federally endangered species, typically occurs on sparsely vegetated sandbars in wide river channels, but also will nest in sand and gravel pits (USFWS 2014). The interior least tern was not identified in species surveys of the Paducah Site (CH2M HILL 1991; CH2M HILL 1992).
Mussels	*Quadrula cylindrica*	Rabbitsfoot	Threatened	The rabbitsfoot mussel species, a federally threatened species, has federally designated critical habitat near the Paducah Site. The rabbitsfoot mussel and the other mussel species have not been identified in the waters near the Paducah Site; however, they have been recorded in the Ohio River between river miles 945 and 949, downstream of the 2000). The rabbitsfoot mussel occurs throughout portions of the southern and eastern United States. Rabbitsfoot most commonly occurs in small- to medium-sized streams, but also occurs in some larger rivers. Critical habitat for this species has been designated in portions of the Ohio River near Metropolis, Illinois (USFWS 2019b).
	Pleurobema clava	Clubshell	Endangered	The clubshell mussel, a federally endangered species, typically occurs in clean, loose gravel and sand in small to medium rivers and streams (USFWS 1997).
	Cyprogenia stegaria	Fanshell	Endangered	The fanshell mussel, a federally endangered species, occurs in medium to large rivers, where it buries itself in gravel or sand in deep water (USFWS 2018a).
	Epioblasma torulosa rangiana	Northern riffleshell	Endangered	The northern riffleshell, a federally endangered species, inhabits a wide variety of streams from large to small, burying itself in sand or gravel (USFWS 2018b).
	Epioblasma obliquata	Purple cat's paw	Endangered	The purple cat's paw mussel, a federally endangered species, lives in large rivers of the Ohio River basin, typically in shallow water with a swift current (USFWS 2018c).
	Cumberlandia monodonta	Spectaclecase	Endangered	The spectaclecase mussel, a federally endangered species, inhabits large rivers in areas sheltered from the force of the current (USFWS 2018d).
	Potamilus capax	Fat pocketbook	Endangered	The fat pocketbook mussel, a federally endangered species, occurs in sand, mud, and fine gravel bottoms of large rivers, where it buries itself in the substrate (USFWS 2018e).
	Pleurobema plenum	Rough pigtoe	Endangered	The rough pigtoe mussel, a federally endangered species, is endemic to the Ohio River system and occurs in stable mixed substrates. It is believed to not be present in McCracken County (USFWS 2007).

Table C.1. Federally Listed Species in or Near the Paducah Site (Continued)

Group	Scientific Name	Common Name	Federal Status	Habitat Comments
Mussels (Continued)	*Plethobasus cooperianus*	Orangefoot pimpleback	Endangered	The orangefoot pimpleback mussel, a federally listed endangered species, inhabits gravel and sand shoals and riffles in large rivers, including the Ohio River (USFWS 2019c).
	Obovaria retusa	Ring pink	Endangered	The ring pink mussel, a federally endangered species, is found in shallow water over silt-free sand and gravel bottoms of large rivers. There are historical records of this species from the Ohio River (USFWS 2018f).
	Plethobasus cyphyus	Sheepnose	Endangered	The sheepnose mussel, a federally endangered species, occurs across the Midwest and Southeast but has been eliminated from much of its historical range. Sheepnose live in larger streams and rivers in shallow areas with moderate to swift current that flow over coarse sand and gravel. However, sheepnose also can live in areas of mud, cobble, and boulders (USFWS 2018g).

Source: KDFWR (2014b); USFWS (2019a).
*Species not considered as occurring at the Paducah Site area according to USFWS Information, Planning, and Consultation System data.
KDFWR = Kentucky Department of Fish and Wildlife Resources
KSNPC = Kentucky State Nature Preserves Commission
USFWS = U.S. Fish and Wildlife Service
WKWMA = West Kentucky Wildlife Management Area

Table C.2. Commonwealth-Listed Species in or Near McCracken County

Group	Scientific Name	Common Name	Commonwealth Status
Mammals	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat	Special Concern
	Myotis austroriparius	Southeastern myotis	Endangered
	Myotis septentrionalis	Northern myotis	Endangered
	Myotis sodalist	Indiana bat	Endangered
	Nycticeius humeralis	Evening bat	Special Concern
	Peromyscus gossypinus	Cotton mouse	Threatened
Fish	*Acipenser fulvescens*	Lake sturgeon	Endangered
	Atractosteus spatula	Alligator gar	Endangered
	Cyrpinella venusta	Blacktail shiner	Special Concern
	Erimyzon sucetta	Lake chubsucker	Threatened
	Esox niger	Chain pickerel	Special Concern
	Etheostoma proeliare	Cypress darter	Threatened
	Euphyes dukesi	Dukes' skipper	Threatened
	Hybognathus hayi	Cypress minnow	Endangered
	Ichthyomyzon castaneus	Chestnut lamprey	Special Concern
	Ictiobus niger	Black buffalo	Special Concern
	Lota lota	Burbot	Special Concern
	Lepomis marginatus	Dollar sunfish	Endangered
	Lepomis miniatus	Redspotted sunfish	Threatened
	Menidia audens	Mississippi silverside	Threatened
	Notropis hudsonius	Spottail shiner	Special Concern
	Notropis maculatus	Taillight shiner	Threatened
	Noturus stigmosus	Northern madtom	Special Concern
	Umbra limi	Central mudminnow	Threatened
Birds	*Accipiter striatus*	Sharp-shinned hawk	Special Concern
	Ammodramus henslowii	Henslow's sparrow	Special Concern
	Anas discors	Blue-winged teal	Threatened
	Ardea alba	Great egret	Threatened
	Certhia Americana	Brown creeper	Endangered
	Chondestes grammacus	Lark sparrow	Threatened
	Circus cyaneus	Northern harrier	Threatened
	Cistothorus platensis	Sedge wren	Special Concern
	Corvus ossifragus	Fish crow	Special Concern
	Dolichonyx oryzivorus	Bobolink	Special Concern
	Falco peregrinus	Peregrine falcon	Endangered
	Fulica Americana	American coot	Endangered
	Haliaeetus leucocephalus	Bald eagle	Threatened
	Ictinia mississippiensis	Mississippi kite	Special Concern
	Junco hyemalis	Dark-eyed junco	Special Concern

Table C.2. Commonwealth-Listed Species in or Near McCracken County (Continued)

Group	Scientific Name	Common Name	Commonwealth Status
Birds (Continued)	*Lophodytes cucullatus*	Hooded merganser	Threatened
	Nyctanassa violacea	Yellow-crowned night-heron	Threatened
	Pandion haliaetus	Osprey	Special Concern
	Peucaea aestivalis[a]	Bachman's sparrow	Endangered
	Phalacrocorax auritus	Double-crested cormorant	Threatened
	Podilymbus podiceps	Pied-billed grebe	Endangered
	Riporia	Bank swallow	Special Concern
	Sternula antillarum athalassos	Interior least tern	Endangered
	Tyto alba	Barn owl	Special Concern
	Vermivora chrysoptera	Golden-winged warbler	Threatened
	Viero bellii	Bell's vireo	Special Concern
Mussels & Mollusks	*Lampsilis abrupta*	Pink mucket	Endangered
	Leptoxis praerosa	Onyx rocksnail	Special Concern
	Lioplax sulculosa	Furrowed lioplax	Special Concern
	Lithasia armigera	Armored rocksnail	Special Concern
	Lithasia geniculate	Ornate rocksnail	Special Concern
	Lithasia verrucosa	Varicose rocksnail	Special Concern
	Obovaria retusa	Ring pink	Endangered
	Plethobasus cooperianus	Orangefoot pimpleback	Endangered
	Plethobasus cyphyus	Sheepnose	Endangered
	Pleurobema rubrum	Pyramid pigtoe	Endangered
	Potamilus capax	Fat pocketbook	Endangered
	Potamilus purpuratus	Bleufer	Endangered
	Theliderma cylindrical	Rabbitsfoot	Threatened
	Toxolasma lividum	Purple lilliput	Endangered
Reptiles	*Apalone mutica*	Midland smooth softshell	Special Concern
	Farancia abacura reinwardtii	Western mudsnake	Special Concern
	Macrochelys temminckii	Alligator snapping turtle	Threatened
	Thamnophis sauritus	Eastern ribbon snake	Special Concern
Amphibians	*Cryptobranchus alleganiensis*	Eastern hellbender	Endangered
	Rana areolata circulosa	Northern crawfish frog	Special Concern
Crustacean	*Faxonius lancifer*	Shrimp crayfish	Endangered
Insects	*Satyrium favonius ontario*	Northern hairstreak	Special Concern

[a] The Bachman's sparrow is a federally listed species that was not identified by USFWS as potentially occurring on or near the Paducah Site.
Source: KDFWR (2014b).

Table C.3. Commonwealth-Listed Species in McCracken County, Kentucky

Scientific Name	Common Name	Commonwealth Status
Aesculus pavia	Red buckeye	Threatened
Armoracia lacustris	Lakecress	Threatened
Baptisia braceata var. glabrescens	Cream wild indigo	Special Concern
Carya aquatic	Water hickory	Threatened
Chelone obliqua var. speciose	Rose turtlehead	Special Concern
Gleditsia aquatic	Water locust	Special Concern
Halesia tetraptera	Common silverbell	Endangered
Heterotheca subaxillaris var. latifolia	Broad-leaf golden-aster	Threatened
Hydrolea ovata	Ovate fiddleleaf	Endangered
Lespedeza stuevei	Tall brush-clover	Special Concern
Melanthera nivea	Snow squarestem	Special Concern
Muhlenbergia glabrifloris	Hair grass	Special Concern
Myriophyllum heterophyllum	Broadleaf water-milfoil	Special Concern
Prenanthes aspera	Rough rattlesnake-root	Endangered
Rudbeckia subtomentosa	Sweet coneflower	Endangered
Solidago buckleyi	Buckley's goldenrod	Special Concern

Source: KYNP (2018).

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APPENDIX D

ANALYSIS OF ON-SITE TREATMENT OF LOW-LEVEL RADIOACTIVE WASTE, MIXED LOW-LEVEL RADIOACTIVE WASTE, AND OTHER WASTE MANAGEMENT ACTIVITIES

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D.1. INTRODUCTION

This appendix analyzes the potential radiological risks and impacts associated with the Proposed Action and No Action Alternative for the on-site treatment of low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), and other waste management activities in accordance with the Resource Conservation and Recovery Act (RCRA) permit, safety basis documents, and procedures at the U.S. Department of Energy (DOE) Paducah Site. Some LLW or MLLW may require treating or converting the waste form before shipment for disposal. Other wastes may be treated to reduce disposal costs or avoid disposition survey expense. The volume reduction of fluorescent light bulbs is an example of the latter. R-114, if required to be dispositioned as a waste, is an example of waste that likely would be treated or converted off-site. Chemical risks and impacts associated with on-site treatment of wastes under the Proposed Action also are correlated to the analysis in the 2002 Environmental Assessment (EA) (DOE 2002a) in this appendix.

In the Proposed Action, the wastes would be stored on-site pending on-site treatment or shipment off-site for treatment and/or disposal. The on-site activities include, but are not limited to, storing steel waste containers, mechanically handling waste containers, and opening waste containers under controlled conditions to allow treatment (for example, solidification of liquids, grouting). Presently, most MLLW that requires treatment prior to disposal would be shipped to commercial off-site facilities for treatment. On-site treatment would be reserved for wastes that cannot be shipped effectively in their current form, wastes that are reduced significantly in volume by treatment, and wastes that do not have effective commercial disposal options in an untreated state. In general, off-site commercial treatment of MLLW provides cost and schedule advantages to the deactivation program at the Paducah Site. Under the No Action Alternative, all wastes would be stored on-site and no on-site treatment would be performed.

D.2. PROPOSED ACTION

The 2002 EA analyzed the treatment and disposal of approximately 413,000 cubic feet (ft^3) of LLW and MLLW during a 10-year period. This update analyzes the treatment and disposal of approximately 5,050,000 ft^3 of mostly LLW and MLLW[1] during a 12-year period beginning in fiscal year 2020, which is more than a factor of 10 greater than the waste volume analyzed in the previous EAs (DOE 2002a; DOE 2003). Large components being shipped as LLW or MLLW would constitute approximately 76% of the total waste volume. These large components primarily would ship as intact items; therefore, they would require only removal from process buildings and packaging, but not waste form processing. As a result, approximately 24% of the total waste volume would be the maximum volume of waste assumed to be treated or converted on-site before shipment for off-site disposal in this analysis, which is an overestimation based on previous on-site waste management experience. There also is a quantity of excess material, R-114, that may be shipped off-site for destruction if reuse opportunities are not available. Disposition of the excess R-114 material would not involve on-site treatment; therefore, R-114 is not analyzed further in this appendix.

In general, the LLW streams contain a mixture of radioactive isotopes and toxic metals. The chemical risk associated with toxic metals in LLW was evaluated in the 2002 EA (DOE 2002a). In the 2002 EA, the concentration of each metal contaminant was estimated to be 5,000 parts per million, and these concentrations were converted to a surrogate mass of chromium (Cr) based on toxicity equivalence. The 2002 EA developed an exposure scenario that resulted in an exposure of the uninvolved worker to a

[1] Less than 1% of the total of 5,050,000 ft^3 of waste is nonradioactive RCRA waste.

concentration of 0.02 milligram (mg) Cr/cubic meter (m^3). The concentrations of toxic metals in the Paducah Site's process systems, therefore, the resulting waste, have not increased since 2002. The LLW and MLLW treatment systems and batch quantities also have not changed since that time, so the previous analysis in the 2002 EA remains applicable to the present Proposed Action. The current Occupational Safety and Health Administration permissible exposure limit for Cr metal is 1 mg Cr/m^3 averaged over 8 hours; therefore, the toxic metal concentrations based on a Cr toxicity equivalence are only 2% of current protection thresholds for workers.

The chemical risk to the general population was not calculated in the previous assessment. Toxic metals at the Paducah Site typically would be found within the particulate emissions from the Proposed Action activities. All of the Proposed Action activities with the potential to emit particulates would utilize negative air machines with high efficiency particulate filters to reduce the potential of emissions. Toxic metals would not be emissions of concern for waste treatment activities.

In order to bound the radiological impact to the general population, the maximum amount of waste that would undergo on-site treatment prior to shipping is assumed to be 24% of the total waste volume, which, as stated previously, is an overestimation of the volume of waste that would be treated on-site. This value is not considered to be a limit or absolute volume in the context of this EA because discoveries or changes in waste classification guidelines could increase or decrease the fraction of waste that is processed on-site.

The Paducah Site has a RCRA permit and a DOE safety basis authorization that allow certain waste treatment activities. Any of these permitted or authorized processes may be performed during the Proposed Action. Examples of these activities include neutralizing acidic or basic waste streams, stabilizing uranium hexafluoride (UF_6), reducing the size of fluorescent light bulbs, size reducing process equipment and systems, and down blending enriched uranium recovered from process traps and other process components. These treatment processes typically would be completed in relatively small batches under high-efficiency particulate air ventilation controls inside buildings that are subject to stringent administrative controls. In some cases, treatment may be in open air, as appropriate, and as stipulated in permits and safety evaluations. Any appropriate RCRA-permitted or authorized waste storage or staging facility or location at the Paducah Site may be used for approved treatment activities. Because of the relatively small volumes of LLW and MLLW that actually are treated and because such treatment involves increased layers of emissions controls, the emissions associated with this activity would contribute very little radiation dose to workers or the general population. The radiological impacts and risks associated with the Proposed Action are detailed in the following sections.

D.2.1 DOSE TO WORKERS

The dose consequences to workers may be estimated from the recent occupational radiation dose data for the Paducah Site. For 2017, the most recent year for which annual data are available, the DOE annual occupational radiation exposure report stated that 5.2E+00 person-rem[2] (p-rem) of collective radiation dose was recorded by 113 workers at Paducah (DOE 2018). This is an average of 4.6E-02 rem per year per exposed worker. No other workers received measurable radiation doses.

Assuming, based on waste treatment operations experience, that a maximum of 45 workers would be involved in on-site waste management activities on a full-time equivalent basis (FRNP 2019), and that these 45 workers experience a radiation dose of 4.6E-02 rem per year, the annual dose impact from waste management activities may be calculated as follows:

[2] A person-rem (p-rem) is a unit of the collective dose of radiation to a population. It represents the product of the average dose per person times the number of people exposed.

45 workers × 4.6E-02 rem/year per exposed worker = 2.1E+00 p-rem/year

To consider the potential magnitude of latent health effects to the involved worker population from a collective dose of 2.1 p-rem per year, the latent cancer fatality (LCF) risk factor, 6.E-04 LCF per rem, may be applied (ISCORS 2002). The result is as follows:

2.1E+00 p-rem/year × 6.E-04 LCF/rem = 1.E-03 LCF/year to the worker population

The total risk to the worker population during the 12-year period of the Proposed Action was calculated as follows:

1.E-03 LCF/year × 12 years = 1.E-02 LCF for the entire 12-year period

To protect workers from impacts from radiological exposure, 10 *CFR* Part 835 imposes an individual dose limit of 5 rem per year. The estimated annual worker dose (4.6E-02 rem per year) is much smaller than the dose limit. In addition, workers are protected from workplace hazards through appropriate training, protective equipment, monitoring, materials substitution, and engineering and management controls to maintain radiation exposure as low as reasonably achievable.

Because the average background and man-made sources of radiation exposure of U.S. citizens, including medical sources, (hereinafter referred to as background) is 6.2E-01 rem per year (NCRP 2009),[3] the total background dose to the involved workers is as follows:

45 workers × 6.2E-01 rem/year = 2.8E+01 p-rem/year

The calculated radiation dose from the on-site waste management activities for the involved workers, therefore, is as follows:

$$\frac{\text{2.1E+00 p-rem/year collective dose}}{\text{2.8E+01 p-rem/year collective background dose}} \times 100 = \text{8\% of the background dose to the average involved worker}$$

D.2.2 POPULATION DOSE

The 2018 Annual Site Environmental Report for the Paducah Site states that the estimated potential collective population dose or dose to the general population from the Paducah Site (all relevant pathways) was 7.6E-01 p-rem per year (FRNP 2020). For all of the relevant pathways that could impact the collective population, airborne emissions from on-site activities dealing with generation and on-site transport and disposal of waste, decontamination and maintenance of contaminated equipment, and other site activities (activities similar to the Proposed Action) could create the highest population impact. Of this collective dose, 6.0E-04 p-rem or 0.08% of the collective dose was attributed to air emissions from operations. If all of the collective population dose from air emissions in 2018 is assumed to result from on-site waste management activities and if this dose increased by a factor of 10 as a result of the increased volume of waste disposition under the Proposed Action as compared to the previous EAs, the estimated potential annual collective population dose for the Proposed Action would be as follows:

[3] Members of the population are routinely exposed to natural and man-made sources of ionizing radiation. Half of the radiation dose to a member of the population, about 310 mrem/year, is from natural sources of cosmic and terrestrial origin. The other half is from man-made sources, including diagnostic and therapeutic X-rays, tomography, and fluoroscopy; nuclear medicine; consumer products, such as cigarettes and smoke detectors; fallout from nuclear weapon tests; industrial, research, and educational applications; and effluents from nuclear facilities (FRNP 2020).

6.0E-04 p-rem/year × 10 volume factor = 6.0E-03 p-rem/year

The upper bound estimate of the population risk associated with on-site waste management activities under the Proposed Action would be as follows:

6.0E-03 p-rem/year × 6.E-04 LCF/rem = 4.E-06 LCF/year to the collective population

The annual collective risk is calculated to be 4.E-06 LCF per year spread over all members of the general population.

The total risk to the general population during the 12-year period of the Proposed Action was calculated as follows:

4.E-06 LCF/year × 12 years = 5.E-05 LCF for the entire 12-year period

D.2.3 MAXIMALLY EXPOSED INDIVIDUAL DOSE

The estimated potential dose to the maximally exposed individual (MEI) from the Paducah Site (all relevant pathways) in 2018 was 5.1E-03 rem (FRNP 2020). For all of the relevant pathways that could impact the MEI, airborne emissions from on-site activities dealing with generation and on-site transport and disposal of waste, decontamination and maintenance of contaminated equipment, and other site activities (activities similar to the Proposed Action) could create the highest impact. Of this collective dose, 9.0E-08 rem was attributed to air emissions from operations. The Clean Air Act (Subpart H of 40 *CFR* Part 61) establishes that a DOE facility cannot exceed emissions that would cause any member of the population to receive an effective dose equivalent of 1.0E-02 rem per year. If all of the estimated potential dose to the MEI from air emissions is assumed to result from on-site waste management activities, the estimated dose to the MEI attributed to air emissions from waste treatment at the Paducah Site is as follows:

$$\frac{\text{9.0E-08 rem}}{\text{1.0E-02 rem}} \times 100 = 0.0009\% \text{ of the regulatory limit}$$

In addition, if all of the estimated potential dose to the MEI from air emissions in 2018 assumed to result from on-site waste management activities, and if this dose increased by a factor of 10 as a result of the increased volume of waste disposition under the Proposed Action as compared to the previous EAs, the estimated potential annual dose to the MEI for the Proposed Action would be as follows:

9.0E-08 rem/year × 10 volume factor = 9.0E-07 rem/year

The upper bound estimate of the MEI risk associated with on-site waste management under the Proposed Action then would be as follows:

9.0E-07 rem/year × 6.E-04 LCF/rem = 5.E-10 LCF/year

Assuming the average member of the population receives 6.2E-01 rem of radiation dose each year from background sources (NCRP 2009) and the increment from waste treatment at the Paducah Site amounts to 9.0E-07 rem per year, the total estimated radiation exposure to the MEI, including on-site treatment of LLW and MLLW, would be not be different from the background dose of 6.2E-01 rem per year.

The total risk to the MEI during the 12-year period of the Proposed Action was calculated as follows:

5.E-10 LCF/year × 12 years = 6.E-09 LCF for the entire 12-year period

D.3. NO ACTION ALTERNATIVE

In the No Action Alternative, DOE would not perform off-site treatment and disposal activities and would continue only on-site waste storage and on-site disposal activities.[4] No new projects that would generate waste would be undertaken (that is, deactivation of facilities to prepare for decommissioning and disposition of excess R-114). Only surveillance and maintenance (S&M) of the Paducah Site facilities would be conducted. Because S&M would be ongoing into the foreseeable future with no diminishing radiation risk from waste being shipped off-site, a 100-year accrual period was used to assess impacts to the workers under the No Action Alternative. The only wastes that would be generated would result from routine S&M activities (total of 1,237,000 ft^3). The radiological impacts and risks associated with the No Action Alternative are detailed in the following sections.

D.3.1 DOSE TO WORKERS

The dose consequences to workers were estimated from the recent occupational radiation dose data for the Paducah Site. For 2017, the most recent year for which annual data are available, the DOE annual occupational radiation exposure report stated that 5.2E+00 person-rem (p-rem) of collective radiation dose was recorded by 113 workers at Paducah (DOE 2018). Because the radioactive material to be dispositioned during the Proposed Action currently is on-site within equipment, systems, and facilities, this entire collective occupational radiation dose for 2017 is assumed to be the annual collective dose to the involved worker population under the No Action Alternative.

To consider the potential magnitude of latent health effects to the involved worker population from a collective dose of 5.2E+00 p-rem per year, the LCF risk factor, 6.E-04 LCF per rem, may be applied (ISCORS 2002). The result is as follows:

5.2E+00 p-rem/year × 6.E-04 LCF/rem = 3.E-03 LCF/year to the worker population

During the 12-year period, this would result in the following:

12 years × 3.E-03 LCF/year = 4.E-02 LCF for the entire 12-year period

For comparison to the Proposed Action 12-year period, the total risk for the No Action Alternative was calculated to be 4.E-02 LCF to the worker.

For the 100-year period of the No Action Alternative, this would result in the following:

100 years × 3.E-03 LCF/year = 3.E-01 LCF for the entire 100-year period

The radiation dose from the on-site waste management activities for the involved workers under the No Action Alternative would be the same as under the Proposed Action (that is, 8% of the background dose

[4] On-site disposal of nonhazardous, nonradioactive solid wastes within DOE authorized release limits would continue in accordance with DOE/EA-1414 (DOE 2002b). This EA (DOE/EA-2116) does not address on-site disposal covered under the separate EA (DOE 2002b).

to the average involved worker). The occupational radiation exposure of workers at the site is monitored continuously and summarized on an annual basis in an annual report.

D.3.2 POPULATION DOSE

The 2018 Annual Site Environmental Report for the Paducah Site states that the estimated potential collective population dose from the Paducah Site (all relevant pathways) was 7.6E-01 p-rem per year (FRNP 2020). If all of the collective population dose in 2018 is assumed to result from on-site waste management activities, the upper bound estimate of the population risk associated with on-site waste management activities under the No Action Alternative would be as follows:

7.6E-01 p-rem/year × 6.E-04 LCF/rem = 5.E-04 LCF/year to the collective public

The annual collective risk is calculated to be 5.E-04 LCF spread over all members of the population. Assuming this dose continues for 100 years, the most likely radiological impact of the No Action Alternative to members of the public near the Paducah Site would results as follows:

100 years × 5.E-04 LCF/year = 5.E-02 LCF for the entire 100-year period

D.3.3 MAXIMALLY EXPOSED INDIVIDUAL DOSE

The estimated potential dose to the MEI from the Paducah Site (all relevant pathways) in 2018 was 5.1E-03 rem (FRNP 2020). Because the radioactive material to be dispositioned during the Proposed Action currently is on-site within equipment, systems, and facilities, the 2018 estimated potential dose to the MEI is assumed to be the dose to the MEI under the No Action Alternative. The upper bound estimate of the dose to the MEI associated with on-site waste management activities under the No Action Alternative would be as follows:

5.1E-03 rem/year × 6.E-04 LCF/rem = 3.E-06 LCF/year

Assuming this dose continues for 100 years, the most likely radiological impact of the No Action Alternative to the MEI at the Paducah Site would results as follows:

100 years × 3.E-06 LCF/year = 3.E-04 LCF for the entire 100-year period

For comparison to the Proposed Action 12-year period, the total risk for the No Action Alternative was calculated to be 3.E-04 LCF, for the entire 100-year period, to the MEI or no cancer fatalities. Assuming the average member of the public receives 6.2E-01 rem of radiation dose each year from background sources (NCRP 2009) and the incremental potential dose to the MEI from on-site activities at the Paducah Site under the No Action Alternative is 5.1E-03 rem, the total estimated radiation exposure to the MEI, including on-site activities, would result in a negligible increase to the background dose of 6.2E-01 rem per year.

D.4. REFERENCES

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APPENDIX E

TRANSPORTATION ACCIDENT ANALYSIS

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E.1. INTRODUCTION

A 12-year period, beginning in fiscal year (FY) 2020, was selected to evaluate potential radiological transportation impacts for this Environmental Assessment (EA). The estimated waste disposal volumes during this period will result from the ongoing deactivation and remediation activities at the U.S. Department of Energy (DOE) Paducah Site. The activities that are evaluated are outside the jurisdiction of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Environmental Management (EM). Table E.1 summarizes the planning basis for waste volumes, rounded to the nearest thousand cubic feet (ft^3), during this period. For the purpose of calculating potential safety and health impacts, all of the wastes were assumed trucked to Mercury, NV, from the Paducah Site and also assumed to be shipped by rail to Richland, WA, from the Paducah Site. Because these are the furthest expected truck and rail routes, respectively, the impacts of these transportation actions generally bound transportation to the closer disposition sites. In addition, the Paducah Site has a quantity of excess refrigerant (R-114) material that presently is being held for reuse. The potential disposition of R-114, detailed in Table E.2, also is included in this evaluation.

Although it is feasible to have shorter routes with higher radiological dose impacts, a previous assessment (DOE 2002) determined that the radiation doses for likely alternative routes (Clive, UT, and Andrews, TX) have on average 10% lower doses per shipment. No other sites are reasonably expected to receive a large fraction of the overall low-level radioactive waste (LLW) disposal volume.

Table E.1. Waste Types, Volumes, and Disposal Modes for 12-Year Period Beginning in FY 2020

Waste Type	Volume to be Shipped Over 12 Years (ft^3)	Proposed On-Site Treatment[a]	Proposed Off-Site Treatment	Proposed On-Site Disposal	Proposed Off-Site Disposal
LLW/MLLW—large components	3,813,000	X	X		X
LLW—solid disposal	1,025,000	X	X		X
MLLW—solid disposal	112,000	X	X		X
MLLW—liquid disposal	67,000	X	X		X
Nonradioactive RCRA—hazardous	33,000	X	X		X
Total volume	5,050,000				

Notes:
[a] A small percentage of each waste type may undergo some minimal controlled on-site treatment, such as sedimentation, precipitation, oxidation, compaction, macroencapsulation, neutralization, and cementation/solidification.
ft^3 = cubic foot/feet
LLW = low-level radioactive waste
MLLW = mixed low-level radioactive waste
RCRA = Resource Conservation and Recovery Act

Table E.2. Excess R-114 Types and Volumes Beginning in FY 2020

Excess Material Type	Quantity (lb)	Volume (ft^3)
Nonradioactive R-114	7,650,000	84,000
Radioactive R-114	850,000	9,000
Totals	8,500,000	93,000

The R-114 material quantities were converted to volumes using a density of 91.15 lb per ft^3. At this density, the total volume of R-114 that may be shipped is approximately 93,000 ft^3, and the portion assumed to be radioactive waste would be 9,000 ft^3. These figures have been rounded to the nearest thousand ft^3. The transportation calculations are based on the weight of R-114 shipped. Volumes have been provided for comparison only to the waste volumes in Table 2 (main text) and Table E.1.

This EA is based on a forecast of expected waste and R-114 shipments and their radioactive contents. The category of large components includes converters, compressors, and other portions of large systems that are shipped in relatively intact configurations. The total waste volume with a radioactive component forecast for this EA is 5,059,000 ft^3. This total waste volume includes approximately 33,000 ft^3 of nonradioactive RCRA hazardous waste. These wastes contain background levels of radioactivity and are included in the calculation of radiation dose to transportation workers or off-site populations to be protective of the public health and safety.

The actual number and size of shipments during this period may be larger than those forecast. Also, the time period required to complete the shipments may be longer than forecast. While total impacts would be the same, under this scenario, annual impacts would be smaller, but would occur for more years. Though the actual waste shipment program may diverge from the forecast that is assessed in this EA, the findings of this EA are considered valid, unless an increase in waste volume would be considered a substantial change (pursuant to 40 *CFR* § 1502.9 and 10 *CFR* § 1021.314) relevant to environmental concerns.

E.2. SCREENING APPROACH

Consistent with the Council on Environmental Quality's instruction to discuss potential impacts "in proportion to their significance" [(Title 40 *CFR* § 1502.2(b)], DOE determines the appropriate level of detail of impact analysis, including transportation impact analysis, on a case-by-case basis. This determination is based on the nature of the proposed action and alternatives and the potential significance of potential impacts as discussed in 40 *CFR* § 1508.27.

DOE analyses consistently have shown that the impacts of the transportation of radioactive materials are generally small and often overwhelmed by the nonradiation impacts of that same transportation. For DOE actions where minimal impacts are expected from the transportation of radioactive materials, completely new quantitative analysis may not be necessary to assess the potential impacts of transporting radioactive materials or waste. Instead, DOE may use a simple screening analysis, with appropriately conservative estimates to identify an upper bound on potential impacts. This screening estimate may be used to show whether potential impacts will be significant and determine the need for further analysis.

If the results of this analysis show that the potential risk is small or nonexistent, then further analysis may not help decision makers or the public. In such cases, DOE may include a negative declaration of significant impact, accompanied by a brief explanation of the methodology and sources relied upon in arriving at conclusions regarding potential risks (40 *CFR* § 1502.24).

Similar analyses (for example, similar material, packaging, start points, and end points) may be incorporated by reference (40 *CFR* § 1502.21) and used to develop an estimate for use in a screening analysis. Combining aspects of previously existing analysis and new analysis can help reduce duplicative effort and paperwork (40 *CFR* § 1506.4).

The data in previous National Environmental Policy Act (NEPA) evaluations were updated and used for a screening calculation assessment of radioactive material transportation for Paducah Site deactivation and non-CERCLA EM wastes. The data in previous NEPA evaluations (DOE 2002; DOE 1997) were reviewed and analyzed to establish dose factors for transport of LLW and MLLW by truck or rail.

E.3. DOSE FACTORS AND PARAMETERS

This screening analysis calculates the dose to transportation workers and members of the population who reside near or utilize the same transportation routes with the proposed radioactive material shipments (Sandia 2013). The screening analysis methodology uses doses associated with truck and rail transport in a previous environmental impact statement to establish dose factors that are applied to the waste stream data in Table E.1 and the radioactive portion of the R-114 listed in Table E.2 (DOE 1997). As developed for this analysis, the dose factors are functions of the transportation mode (truck or rail), the receptor, and the distance traveled. Distance traveled is being used as a proxy for both crew time of exposure and of exposed population.

The waste packages were assumed to be a combination of drums, ST-90 boxes, intermodal containers, gondola railcars, and large individual items. The large individual items may be converters, compressors, or other portions of equipment or systems. The waste volumes were converted to weight units for the purpose of calculating the number of truck shipments or railcars. An average density of 25 lb per ft^3 was estimated for all of the waste in Table E.1. Each truck was assumed to carry 44,000 lb of waste, and each railcar was assumed to carry 120,000 lb of waste.

The dose to the maximally exposed individual (MEI) is calculated in units of roentgen equivalent man (rem). The rem is the common unit of external dose rate. The appropriate unit of collective dose is person-rem (p-rem), which is a measure of the total radiation dose of a population. In this EA, the population dose is calculated for truck crews, railroad crews, and the general population that may be exposed to radiation from transportation shipments of radioactive waste.

The external dose rate of each truck or rail shipment is assumed to have a value of 1.E-03 rem per hour in this EA, which is based on a measure of the radiation dose rate that a person located 1 meter (m) from a truck trailer or railcar would receive. U.S. Department of Transportation (DOT) also requires that the dose rate from each package be measured prior to shipment. Paducah Site records indicate that dose rates at a 1-m distance from LLW truck trailers or railcars departing the Paducah Site have ranged from nondetectable (that is, background values) to 2.E-04 rem per hour (FRNP 2019). Due to these low numbers, it was determined that utilizing an historical average value might underestimate future waste package dose rates. A value of 1.E-03 rem per hour for all shipments, therefore, is appropriately conservative for this screening approach.

DOT limit inside the cab of the truck is 2.E-03 rem per hour. The dose rate to the crew of a truck or train was calculated using the dose factors obtained from previous DOE assessments (DOE 1997). All of the LLW, MLLW, and radioactive R-114 material were assumed shipped by truck to Mercury, NV, and the same amount of waste was assumed shipped by rail to Richland, WA, to ensure that the resulting calculated impacts are estimated conservatively for this screening estimate. Transportation to any of the other treatment or disposition sites would result in lower impacts to crew and populations due to the shorter distance. A total of 2,889 truck shipments and 1,060 railcar shipments is forecast for the 12-year period. The highway distance from the Paducah Site to Mercury, NV, is 1,790 miles and the rail distance from the Paducah Site to Richland, WA, is 2,388 miles.

E.4. HEALTH EFFECTS

Dose impacts are converted to potential health risks by calculating the latent cancer fatalities (LCFs) that may be associated with specific doses using the linear no-threshold (LNT) hypothesis. This LNT hypothesis assumes that any increment of radiation dose carries an associated risk of an LCF. Additionally, these health risks are termed latent because, typically, the potential cancer would occur approximately 10 to 30 years after the radiation exposure.

The average person in the U.S. receives 0.62 rem or 6.2E-01 rem of radiation dose per year, mostly from natural background sources and medical exposures (NCRP 2009). Doses at this level have not been demonstrated to cause LCFs in humans (NRC 2019). Although the hypothetical LNT hypothesis LCF impacts are less certain compared with transportation accident deaths that are immediate and documented, the analysis is performed using these values to determine all reasonably foreseeable potential impacts from the Proposed Action.

The calculated MEI and collective doses are used to determine potential human health effects in terms of LCFs using risk estimates recommended by the Interagency Steering Committee on Radiation Standards (ISCORS). The LCF dose-conversion factor is 6.E-04 LCF per rem in this calculation. This risk factor accounts for the age and gender distribution in the U.S. population. The risk factor was applied to the individual dose to the MEI and to the total collective doses to the crews and the general population. Though dose calculations are performed with multiple digits of accuracy to reduce rounding errors, the risk factor established by ISCORS (ISCORS 2002) has an accuracy of only one significant figure; therefore, the LCF values are presented with one significant figure in Sections E.6 and E.7.

E.5. POPULATION ADJUSTMENT

The population-based data in prior impact assessments were updated to account for the increase in population density in the U.S. from 1990 to 2035. U.S. Census data estimates indicate that the U.S. population would increase from 248.8 million in 1990 to 358.4 million in 2035; this is an increase of 44.1% (USCB 1996; USCB 2000), which is a population factor of 1.441. This factor will be used only in the population dose calculations; it is not required in the crew dose calculations.

E.6. TRUCK SHIPMENTS

E.6.1 RADIATION DOSE FROM PLANNED TRUCK SHIPMENTS

The general population dose includes persons residing near the truck routes and truck stops and persons who travel the truck shipment routes. Data in previous transportation analyses determined that, under the conditions modeled, the radiation doses on each route to the crews and the population are proportional to the distance traveled (DOE 1997). Identical routes from the Waste Management Programmatic Environmental Impact Statement (WM PEIS) were used to calculate the dose factor by dividing the WM PEIS dose by the average dose rate of the packages and the number of miles. The methodology for calculating population dose is as following:

Dose Factor (p-rem/mi) × Distance (mi/shipment) × Total Trips (shipments)

× Population Adjustment (when required) = Total Dose (p-rem)

The methodology for calculating LCFs is the following:

Total Dose (p-rem) × LCF factor (LCF/rem) = LCF for the entire 12-year period

The potential impact in LCFs per year may be calculated by dividing the total LCFs by 12 years. The dose rate factors and the calculated population doses and LCFs are provided in Table E.3. Please note that the LCFs to the population include the probabilities and consequences of routine transportation and a range of accidents. The accident data incorporate risks related to transportation accidents using accident statistics and damage scenarios reported by DOT.

Truck shipments of large components were assumed to travel 50% slower than normal shipments and require three crew members, compared to two crew members for the typical truck shipments. These factors were taken into account in calculating the dose factors in Table E.3. In practice, a variety of container types and sizes ranging from individual drums to intact components may be used for actual waste shipments. While these differences may affect the dose from individual shipments, they would not affect the dose associated with the total 12-year shipment campaign.

Paducah Site LLW and MLLW truck shipments are conducted using sole-use vehicles and, therefore, require no extended storage of waste packages during truck transportation. While there is no anticipated extended storage of wastes during transit, normal stops at roadside facilities are included in the analysis.

The accident population dose in Table E.3 is based on the radiological risks from breached containers in traffic accidents. The radioactive wastes shipped from the Paducah Site have relatively low radiological toxicity, and the probability of an accident is low, which equates to the probability of release from an accident lower still. Table E.3 shows that the radiation dose from postulated highway accidents involving radioactive wastes is only 3.4% of the radiation dose from the routine transportation of these wastes. Additionally, the radiological risks from breached containers in traffic accidents are small compared with vehicle-related impacts (see Section E.6.2).

Table E.3. Radiation Dose Factors and Population Doses for Truck Shipments

Radiation Dose Type	Radiation Dose Factor (p-rem/mi)	Population Dose (p-rem)	LCFs per year	Total LCFs
Routine crew dose	5.61E-05	2.9E+02	2.E-02	2.E-01
Routine population dose	4.71E-05	3.5E+02	2.E-02	2.E-01
Accident population dose	1.57E-06	1.2E+01		

The dose to the MEI was calculated by assuming that a person was a resident 100% of the time near a road intersection used by all of the truck shipments. Each truck was assumed to stop for 2 minutes (3.33E-02 hour per truck) at a traffic signal at this location. The dose rate to the MEI was calculated using the inverse square law, which states that the intensity is reduced by the square of the distance from the source. The dose at 1 m is 1E-03; at a distance of 10 m, the dose is calculated by dividing the original dose by the square of 10 (100), equating to 1.E-05. Assuming the MEI for truck transport was 10 m from the highway results in a dose factor of 1.E-05 rem per hour. Using the value of 2,889 truck shipments, the MEI dose and LCF calculations for the 12-year period are as follows:

2,889 trucks × 1.E-05 rem/hr × 3.33E-02 hr/truck = 9.6E-04 rem for the entire 12-year period

9.6E-04 rem × 6.E-04 LCF/rem = 6.E-07 LCF for the entire 12-year period

E.6.2 IMPACTS FROM HIGHWAY VEHICLE ACCIDENTS

The National Highway Traffic Safety Administration (NHTSA) reported that, in 2016, 4,251 large trucks were involved in accidents that resulted in 4,369 fatalities in the U.S., which is a rate of 1.0278 fatalities per accident. During 2016, large trucks traveled 287,895 million miles on U.S. highways (NHTSA 2019). The overall fatality rate was 1.5E-02 fatalities per million miles driven. The identified waste streams and destinations result in an estimated 5.2 million miles driven by trucks during the 12-year period of the proposed action. Because the site uses sole-use trucks, the assumption is made that the truck drivers back haul as empty shipments and the total number of miles driven to dispose of the wastes and return to the Paducah Site would be 10.4 million miles.

In addition, this EA assumes that the 7,650,000 lb of excess R-114 that is within DOE's authorized release limits (that is, not LLW) will be shipped to off-site locations for disposition as normal freight. Assuming a truckload limit of 44,000 lb, the disposition of this excess material will result in 0.3 million highway miles if the material is shipped to Mercury, NV. Back hauling the trucks as empty shipments would result in another 0.3 million highway miles. This mileage estimate bounds the expected highway accident impact of these shipments to the off-site treatment and disposal sites. The total number of miles driven is 11.0 million miles.

The estimated number of traffic fatalities for the 12-year period would be as follows:

11.0 million mi × 1.52E-02 deaths/million mi = 2.E-01 deaths

Data that details the number of injuries related to large trucks was published last in 2015. This data reported that 116,000 injuries were related to 279,844 million miles driven by drivers of large trucks. The overall injury rate was 4.15E-01 injuries per million miles driven.

The estimated number of injuries resulting from traffic accidents during the 12-year period would be as follows:

11.0 million mi × 4.15E-01 injuries per million mi = 4.6E+00 injuries

As a result, the total highway safety impact of the Proposed Action would be 4.6E+00 injuries and 2.E-01 highway deaths during the 12-year period of the proposed action.

E.7. RAIL SHIPMENTS

E.7.1 RADIATION DOSE FROM PLANNED RAIL SHIPMENTS

The general population dose includes persons residing near the rail routes and rail sidings, and those persons who travel the rail shipment routes. Data in previous transportation analyses determined that, under the conditions modelled, the radiation doses on each route to the crews and the population are proportional to the distance traveled by each railcar (DOE 1997). Identical routes from the WM PEIS

were used to calculate the dose factor by dividing the WM PEIS dose by the average dose rate of the packages and the number of miles. The methodology for calculating population dose is as follows:

Dose Factor (p-rem/mi) × Distance (mi/shipment) × Total Trips (trains)

× Population Adjustment (when required) = Total Dose (p-rem) for the entire 12-year period

The methodology for calculating LCFs is as follows:

Total Dose (p-rem) × LCF factor (LCF/rem) = LCF for the entire 12-year period

The potential impact in LCFs per year may be calculated by dividing the total LCFs by 12 years. The dose rate factors and calculated population doses and LCFs are provided in Table E.4. The LCF to the population includes the dose from routine transportation and the dose from an accident, which are discussed in detail later.

In practice, a variety of container types and sizes ranging from individual drums to intact components may be used by the Paducah Site for actual waste shipments. Paducah Site waste shipments are not removed from transit until the package(s) arrives at the final destination; however, normal stops during transportation at rail facilities are included in the analysis.

The accident dose in Table E.4 is based on the radiological risks from breached containers in rail accidents. The radioactive wastes shipped from the Paducah Site have relatively low radiological toxicity, and the probability of an accident is low, which is why the potential radiological dose from rail accidents is small compared with the radiation dose from routine shipments. Table E.4 shows that the radiation dose from postulated rail accidents involving radioactive wastes is only 5.9% of the radiation dose from routine transportation of these wastes.

Table E.4. Radiation Dose Factors and Population Doses for Railcar Shipments

Radiation Dose Type	Rail Radiation Dose Factor (p-rem/mi)	Rail Population Dose (p-rem)	Rail LCFs per year	Total LCFs
Routine crew dose	5.44E-06	1.4E+01	7.E-04	8.E-03
Routine population dose	1.07E-05	3.9E+01	2.E-03	2.E-02
Accident population dose	6.28E-07	2.3E+00		

The dose to the MEI was calculated by assuming that a person was a resident 100% of the time at a distance of 100 m from the rail packages. The distance of 100 m was obtained by evaluating typical distances from nearby residences to railcars in the switching yard at Louisville, KY, where most shipments transfer railroad lines. The radiation dose to the MEI is assumed to occur while the railcars are in a rail yard that is used by all of the rail shipments. Each railcar was assumed to stop for 24 hours for switching at this location. The dose rate to the MEI was calculated using the inverse square law, which is protective of the public health and safety because the shielding effect of intervening railcars is not considered. Assuming the dose rate from each railcar is 1.0E-03 rem/hr at 1 m from the railcar, the dose rate to the MEI from one railcar is 1.0E-07 rem/hr according to the inverse square law. Using the rounded-up value of 1,060 railcars, the MEI dose for the 12-year period is as follows:

1,060 railcars × 1.0E-07 rem/hr × 24 hrs/railcar = 2.5E-03 rem for the entire 12-year period

2.5E-03 rem × 6.E-04 LCFs/rem = 2.E-06 LCF for the entire 12-year period

E.7.2 IMPACTS FROM RAIL TRANSPORTATION ACCIDENTS

The Federal Railroad Administration Office of Safety Analysis reported that, in the 10-year period 2006 through 2015, an average of 745,587,000 miles per year were traveled by trains in the U.S. (FRA 2019). During this period, an average of 4,412 rail accidents per year resulted in 281 deaths per year and 1,247 injuries per year. This data is based on documented fatalities and injuries attributed to accidents. Incidents other than rail accidents also contributed to deaths and injuries. The rail accident statistics associated with trains account for 37% of total fatalities and 14% of total injuries during this period.

The overall rail accident fatality rate was 3.77E-01 fatality per million rail miles traveled. The identified waste streams and destinations result in an estimated 2.5 million railcar miles during the 12-year period. The railcars are not assumed to be hauled back empty, because they are not sole-use conveyances.

In addition, this EA assumes that the 7,650,000 lb of R-114 that is within DOE's authorized release limits (that is, not LLW) will be shipped to off-site locations for disposition. Assuming a railcar load limit of 120,000 lb, the disposition of R-114 will result in 64 railcars and 153,000 railcar miles (one-way) if the material is shipped to Richland, WA. Because DOE owns the railcars containing the excess R-114, the empty railcars are assumed to be back hauled to the Paducah Site. This mileage estimate bounds the expected railroad accident impact of these shipments to the off-site treatment and disposal sites. The total number of railcar miles traveled would be 2.8 million miles.

The railcar loading yard at the Paducah Site can accommodate at least five railcars simultaneously. Assuming, that the railcars are shipped in five-car batches, the estimated number of annual traffic fatalities would be as follows:

2.8 million railcar miles/5 railcars per train × 3.77E-01 deaths/million train miles = 2.E-01 deaths

The overall injury rate was 1.67 injuries per million miles driven. The estimated number of injuries resulting from rail accidents during this 12-year period would be as follows:

2.8 million railcar miles/5 railcars per train × 1.67E+00 injuries/million miles = 9.E-01 injuries

As a result, the total railroad safety impact of the Proposed Action would be 2.E-01 deaths and 9.E-01 injuries during the 12-year period.

E.8. COMPARISONS OF RISK

The present analysis is intended to provide a bounding calculation of the overall potential impact of shipping these wastes and excess material. The radioactive dose rates of the packages, the number of shipments, and the distances traveled are maximized to provide conservative estimates of the reasonably foreseeable impacts. Actual shipments of waste to the identified destinations or to other destinations, therefore, can be expected to result in lower impacts and lower risks. The projected LCFs are less than 1 in all analyzed transportation related cases.

The project fatalities from highway or rail accidents also are less than one for the 12-year period, and traffic injuries are calculated in the single digits. As stated above, these calculated quantities are upper bounds. The actual numbers of fatalities are expected to be lower because the estimated number of shipments, amount of radioactivity, and distances traveled have all been bounded by the maximum reasonably foreseeable options.

It is also important to realize that transportation deaths and injuries statistics are based on actual recorded cases that are projected into the future for equivalent transportation activities. Radiological health impacts are based on cancer statistics developed by experience with industrial, medical, and atomic bomb exposures that are projected into the future for situations that have not been shown to cause health effects in humans (NRC 2019).

E.9. REFERENCES

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APPENDIX F

RESPONSE TO STATE AND TRIBAL COMMENTS RECEIVED ON DRAFT PADUCAH GASEOUS DIFFUSION PLANT ENVIRONMENT ASSESSMENT FOR DISPOSITION OF WASTE AND MATERIALS, DOE/EA-2116, APRIL 2020

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Response to State and Tribal Comments Received on the
***Draft Paducah Gaseous Diffusion Plant Environmental Assessment for Disposition of Waste and Materials*,**
DOE/EA-2116, April 2020

Comment Number	Comment	Response
1	**North Carolina State Environmental Review Clearinghouse** : The North Carolina State Environmental Review Clearinghouse is in receipt of the Paducah Gaseous Diffusion Plant EA. After reviewing the document it appears that the project is located in Kentucky and not North Carolina. The North Carolina State Environmental Clearinghouse circulates projects for review and comment that are located within the state of North Carolina.	DOE provided the following response to the North Carolina State Environmental Review Clearinghouse: As described in our email of April 30, 2020, the Department of Energy - Office of Environmental Management (DOE-EM) distributed the draft Environmental Assessment (Draft EA) to states hosting a potential disposition site and a number of states through which transportation may occur. North Carolina received a copy of the draft EA because the Clean Harbors; Reidsville, North Carolina facility is one potential treatment and/or disposal site for nonradioactive Resource Conservation and Recovery Act-hazardous waste. DOE-EM also notified Governor Roy Cooper's office of the pending distribution of the EA on April 29, 2020 and sent the draft EA to that office on April 30, 2020.
2	**California State Clearinghouse**: Thank you for your email. The State Clearinghouse received your email regarding your NEPA project. If there are any state action on this (permits/approval from a state agency/state funding), regarding your NEPA environmental document let us know if this project should be filed with the OPR/SCH for state agency review and comment. I can send you information on how to file your NEPA document in our database online.	DOE provided the following response to the California State Clearinghouse: As described in our email of April 30, 2020, the Department of Energy - Office of Environmental Management (DOE-EM) distributed the draft Environmental Assessment to states hosting a potential disposition site and a number of states through which transportation may occur. Although no potential disposition site is located in California and there is no request for permits/approval from a state agency/state funding at this time, transportation could potentially occur through the State. DOE-EM also notified Governor Gavin Newsom's office of the pending distribution of the EA on April 29, 2020 and sent the draft EA to that office on April 30, 2020.

Comment Number	Comment	Response
3	**Kentucky Division of Waste Management, Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section**: Who is on the distribution list for KY that received the EA on Waste Disposition? I was notified by Louanna Aldridge on April 30th that comments were due on May 14th. It appears that she received an e-mail on April 30th from Bill Ostrum via the "Paducah EA Comments" distribution. I am trying to figure out if April 30th was the first notification that we received and if it was not, then who received the notification on the EA document and when did they receive it.	DOE provided the following response to the Kentucky Division of Waste Management, Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section: Ms. Aldridge is identified in the 2019 DOE NEPA Stakeholders directory as the POC for KY. In addition, the link to the draft EA for review was uploaded to the Kentucky eClearinghouse, and the Governor's Office was notified. DOE NEPA regulations require that DOE "notify the host state and host tribe of a DOE determination to prepare an EA," (10 *CFR* § 1021.301(c) and that "DOE shall provide the…host state and host tribe with an opportunity to review and comment on any DOE EA prior to DOE approval of the EA" (10 *CFR* § 1021.301(d). DOE is providing this draft EA to states and Indian Tribes with land within which DOE is proposing this action, including a portion of the preliminary transportation route. The email notifications, with the link to the EA, went out April 30th with a 14-day review period, with comments due May 14th. Letters of notification also were sent earlier (March 13th) to the same distribution list to make them aware the EA was being prepared and would be forthcoming.

Comment Number	Comment	Response
4	**Nevada Division of Environmental Protection:** The Nevada Division of Environmental Protection (NDEP) is currently reviewing the Paducah Gaseous Diffusion Plant Environmental Assessment for Disposition of Waste and Materials (PGDP EA). The NDEP is the Nevada State Agency that provides oversight of the Department of Energy's (DOE) low-level waste management activities at the Nevada National Security Site (NNSS) under an Agreement-in-Principle. The NDEP received the Draft PGDP EA, via email, on April 30, 2020, at which time a 14-day public comment period began. At this time, the NDEP respectfully requests a 30-day extension be granted to the public review period on the Draft PGDP EA for the following reasons: 1. The NNSS is identified in the Draft PGDP EA as one of nineteen "potential treatment and disposal facilities" for the various waste types generated from DOE's Environmental Management (EM) activities at the PGDP. To date, the NNSS has been EM's chosen disposal site for a large quantity of classified radioactive waste from the PGDP. As such, the NDEP should be afforded enough time to thoughtfully read and format questions to understand how much and what types of the 5,050,000 cubic feet of waste and excess material covered under this EA may be destined for the NNSS. 2. The Draft PGDP EA was released during the current, ongoing COVID-19 pandemic. Ten working days is not sufficient time for a thorough, thoughtful review, especially in light of the daily challenges being faced by state agencies, such as the NDEP, when most, if not all, employees are teleworking. While day-to-day work does continue during this time, dialogue on, and coordination of, comments among NDEP staff is taking several more days than normal since personnel are not in the office together.	In response to the request, DOE extended the comment period for 14 days, until May 28, 2020, via notifications sent on May 14, 2020.

Comment Number	Comment	Response
4 (Continued)	Should you have any questions on the NDEP's request or wish to discuss further, please do not hesitate to contact me at either (702)486-2850, ext. 232 or candres@ndep.nv.gov. Thank you for your consideration of the NDEP's request to extend the comment period on the Draft PGDP EA by an additional 30 days, which would extend the comment period to June 12, 2020.	
5	**THPO Fort Independence Paiute Tribe - California:** Manahuu, I am Sean Scruggs, the THPO for Fort Independence Paiute Tribe in California. As a THPO for my tribe I am on the National Nuclear Security Agency - Consolidated Groups and Tribal Organization Committee and I am also on our Planning Committee. I was alarmed and surprised when I first visited the National Nuclear Security Site at the Mercury Site - there is so much waste coming to that site and it seems, to me, that most of Nevada or even the rest of the state even knows about it. I had the please of addressing the acting director several years ago telling him that a 10,000 year storage plan is ridiculous and that the NNSS/NNSA should stop using the term "disposal" to "managing" low-level or even medium-level waste (radio-active). My heart sank when I was first introduced into the "re-vegetation" project and I saw that they soil is barren on top of what are crates of radioactive waste just 8 feet below. I understand the concept of trying to keep the containers from corroding by wicking the moisture to the top through the roots of plants - but in some places the plants won't grow even though the Native American group has helped tremendously with the project. Now there is a plan to bring even more waste this facility. As a NNSA - CGTO member I DO NOT support the plan to bring more waste to this facility - it presents another hazard along our road	DOE acknowledges the comments, but the comments are outside of the scope of this EA.

Comment Number	Comment	Response
5 (Continued)	ways and here into the state of which I am also a resident. As a support Native American Tribe with ties to NNSA land and the NTTR land, I do not support the plan to continue to bring containers or waste that pose a threat to the animals, land and air here in Nevada. The 10,000 year plan is just a plan and I cannot see how it is viable - I believe that is a plan that will work for maybe 100 years or more if things go well, but the problem will be handed to my replacement if I am lucky to have one by then. We have elders who remind NNSS leaders that Native Americans have been here, on the Holy Lands, since the beginning of time and that Native Americans will continue to be here, on these contaminated Holy Lands long after everyone else has decided to leave - but we will be left with the mess or half of the mess if things work on half-life. I stand with my Native American brothers and sisters with a united message to help protect the land, air and animals here - there's already too much. I have to ask? Of those who write these plan, who among them visited the sites where this waste is going to live, essentially forever?	
6	**Nevada State Clearinghouse (Division of Water Resources)**: If consumptive water is needed for operations in Nevada, all water used on a project must be permitted by the State Engineer's Office. All waters of the State belong to the public and may be appropriated for beneficial use pursuant to the provisions of Nevada Revised Statutes (NRS) Chapters 533 and 534 and not otherwise. All Nevada water laws must receive full compliance.	Consumptive water is not required for the Proposed Action, outside of currently approved use by the Nevada National Security Site (NNSS). Use of water by NNSS has been evaluated as part of the permitting process for NNSS.

Comment Number	Comment	Response
7	**Kentucky State e-Clearinghouse (Kentucky Transportation Cabinet):** Any firm, individual, or government agency desiring access to a State road or desiring to perform any type of work (including signage, boring, etc.) on or adjacent to State right-of-way must obtain a permit from the Permits Department. Any proposed access or encroachment of a State maintained road right-of- way should be coordinated at the earliest stage with: Tom Hines, P.E. Traffic and Permits Kentucky Department of Highways, District 1	No access to or encroachment of a state-maintained road right-of-way is planned as part of the Proposed Action. DOE will comply with all applicable state regulations.
8	**Kentucky State e-Clearinghouse (KY Heritage Council):** To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at http://www.heritage.ky.gov/siteprotect/	No impacts to existing cultural, archaeological, and Native American resources are anticipated from the Proposed Action or alternative (refer to Section 3.1, "Subject Areas Considered but Dismissed from Detailed Analysis," Table 5 of the EA). DOE believes, therefore, that review of the EA is not required by the Kentucky Heritage Council/State Historical Preservation Office. DOE will follow the requirements in the Paducah Site's Kentucky Heritage Council/Kentucky State Historic Protection Office-approved Cultural Resources Management Plan (BJC 2006) for the Proposed Action.
9	**Kentucky Energy and Environment Cabinet (Kentucky Water Resources Branch):** An individual Clean Water Act Section 401 Water Quality Certification from the DOW is required for this project.	No discharge into navigable waters is expected from the transport of waste off-site; therefore, a Clean Water Act Section 401 Water Quality Certification is not expected to be needed.
10	**Kentucky Energy and Environment Cabinet (Kentucky Watershed Management)**: Section 2.1.1 lists absorption as a potential RCRA approved on-site treatment method. Section 2.1.2.4 explains the utility of adsorption using activated carbon as a treatment method. Is the inclusion of one or the other in error? Or, are these two potential treatment methods? If so, what is meant by absorption in the context of on-site treatment?	Absorption and adsorption are both sorption treatment processes that potentially could be used in the Proposed Action. DOE has revised Section 2.1.2.4 of the final EA for to describe both sorption treatment processes.

Comment Number	Comment	Response
11	**Kentucky Energy and Environment Cabinet (Kentucky Watershed Management)**: The commenter agrees with the majority of the impact analysis regarding geology, surface water groundwater, and floodplains and wetlands at the Paducah Gaseous Diffusion Site given the already significant impacts. However, the discussion justifying the inclusion of several subject areas within Section 3.1, Subject Areas Considered and Dismissed From Detailed Analysis, is insufficient. Specifically, the dismissal of, transport related, off-site impacts on surface water, groundwater, and floodplains and wetlands. Per the assessment, from 40 CFR § 1502.2(b), "…there should be only enough discussion to show why more study is not warranted." In the above-mentioned sections, the discussion is limited to the statement that any impacts due to a spill or release during transport "likely would have negligible impact on [insert subject area] off-site because of near-term emergency response actions that would be implemented in accordance with waste transport regulations." Per the PMEIS For Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste cited within the human impacts section (DOE, 1997a) the potential exists, albeit low, for acute impacts on water quality (acute toxicity to aquatic life) for at least some of these materials if released during transport. For the majority of the materials listed in the proposed action, LLW, MLLW, non-radioactive RCRA hazardous waste, the collection of spilled material and containment to prevent release into surface or groundwater would likely be the basis for any response. This includes some proportion of	DOE acknowledges that clean-up of potential spills or releases in a karst environment presents unique challenges. However, the vast majority of the waste proposed to be generated and shipped off-site as part of the Proposed Action is in a solid form with only a small portion of the total volume of waste expected to be in a liquid form (that is, less than 7,000 lb/year of liquid waste or less than 2% of the total volume of waste to be shipped) (refer to Section 2.1 of the EA). The low levels of radioactivity of the liquid wastes, the emergency management procedures in place and the mitigation measures stated in Section 4.3 of the EA (to reduce both the risk of an accident and the risk of a release should an accident occur) are sufficient, in light of project volumes, to minimize any potential off-site impacts to surface water, groundwater, floodplains, and wetlands. Additional study is not warranted. In addition, DOE notes that these transportation routes are used by many commercial carriers and entities to ship hazardous and toxic liquid chemicals and products through these areas on a daily basis. As such, the projected volumes from PGDP do not increase the existing risk presented by current conditions meaningfully. Text has been added to Section 3.2.2.1 of the final EA acknowledging that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations.

Comment Number	Comment	Response
11 (Continued)	mixed liquid/solid MLLW. However, several routes delivering materials to the following locations: Clean Harbors, Cincinnati, OH; Clean Harbors, Reidsville, NC; Energy Solutions, Oak Ridge, TN; Energy Solutions, Clive, UT; Perma-Fix Diversified Scientific Services, Kingston, TN; and Perma-Fix Northwest, Richland, WA, traverse the karst regions roughly included within the Western Kentucky Coal Field, Mississippian Plateaus, and Outer Bluegrass physiographic regions. The hydrogeology of karst regions are characterized by the influence of subsurface conduits on surface and groundwater flow. This results in rapid recharge into karst aquifers and high heterogeneity in hydraulic conductivity within the aquifer. This creates the potential for, as demonstrated by past releases caused by traffic accidents (Turnhole Basin, 2003; Sloans Valley Cave, 2014), the quick introduction of large volumes of contaminants into the aquifer. Furthermore, to the best of the commenter's knowledge, and KYDOW employees, municipal employees for the city of Bowling Green, KY, and subject matter experts consulted, there exists little to no potential for the rapid, if at all, recovery of these materials once they have entered a karst aquifer. This is not to say that remediation examples do not exist. Only that impact mitigation through clean-up is more challenging in karst environments (Kalhor et al., 2019). This is due to the rapid introduction of material into the aquifer, extreme difficulty in locating conduits from the surface quickly, lack of rapid, or any, physical access to the aquifer without drilling, and potentially distributed	

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11 (Continued)	discharge back into surface waters making collection at outlets difficult. (While not entirely analogous, see Ewers et al. (1992) for a discussion of karst aquifer contaminant transport.) Furthermore, these aquifers are populated with endemic species, some endangered (Kentucky Cave Shrimp), provide significant financial benefits through tourism to the region (ex. Mammoth Cave NP and Hidden River Cave) and/or have roles in water supplies. In these areas, prevention is the key to reducing the impacts of transport related spills. The commenter recognizes the likelihood of a significant spill and contaminant introduction during transport is low, and that in-depth analysis of every eventuality is not possible. However, given the particular hydrogeologic characteristics underlying some of the routes, the mitigation of impacts to the above-mentioned subject areas through rapid response and clean-up alone is insufficient to demonstrate the lack of needed additional study.	
12	**Kentucky Energy and Environment Cabinet (Kentucky Watershed Management)**: The assessment includes the potential for new construction to support disposition activities. If any construction is to occur with the Bayou Creek or Little Bayou Creek floodplains, it will require a Kentucky Division of Water Application for Permit to Construct Across or Along a Stream.	No new construction is anticipated within the Bayou Creek or Little Bayou Creek floodplains under the Proposed Action. If DOE identifies new construction that will occur within the Bayou Creek or Little Bayou Creek floodplains, DOE will apply for any necessary permit(s).
13	**Kentucky Energy and Environment Cabinet (Kentucky Watershed Management)**: Portions of the routes within Kentucky used for waste disposition fall within Water Supply Protection Areas for public drinking water sources. If a spill or release occurs, the Kentucky Emergency Response Team should be notified. To report a spill or release call 911 and Environmental Emergency at 1-800-928-2380 or 502-564-2380.	If a spill were to occur, DOE will implement emergency response actions in accordance with DOE and Paducah Site procedures and waste transportation regulations (refer to Section 3.1, "Subject Areas Considered but Dismissed from Detailed Analysis," Table 5 of the EA). This includes any required notifications.

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14	**Kentucky Energy and Environment Cabinet (Kentucky Watershed Management)**: The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, there are domestic groundwater water well users in the vicinity of the proposed work. 401 KAR 6:310 provides minimum standards and requirements for construction, modification, and abandonment of water supply wells. 401 and KAR 6:320 provides for the certification of water well drillers, including the requirements for examination, application, and disciplinary action.	Groundwater water wells currently are not identified for construction, modification, or abandonment as a result of the Proposed Action. If DOE identifies that groundwater water wells are to be constructed, modified, or abandoned, DOE will follow applicable regulations.
15	**Kentucky Energy and Environment Cabinet (Field Operations Branch):** Any spills should be managed and contained under current procedures.	If a spill were to occur, DOE will implement emergency response actions immediately in accordance with DOE and Paducah Site procedures and waste transportation regulations (refer to Section 3.1, Subject Areas Considered but Dismissed from Detailed Analysis, Table 5 of the EA), which include applicable federal and state regulations.
16	**Kentucky Energy and Environment Cabinet (Field Operations Branch):** It is also our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.	The DOE Paducah Site has a Groundwater Protection Plan, PAD-PROJ-0018/FR2, in place.

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17	**Kentucky Energy and Environment Cabinet (Kentucky Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section)**: Page 9, Section 1.6, Stakeholder Participation: "For this EA, in accordance with 10 CFR § 1021.301(c), DOE has sent notification letters to host states and host tribes (Appendix B). DOE also has provided, in accordance with 10 CFR § 1021.301(d), the host states and host tribes with the opportunity to review and comment on this EA [to be determined (TBD) through TBD] prior to approval of the EA." Appendix B should include notification letters to host states and host tribes and it does not. Add all of the letters to Appendix B that were transmitted for review and comment. Also, the last sentence referenced in this comment contains "TBD" as a place holder for dates regarding the review and comment of this Environmental Assessment. Replace the "TBD" with actual dates.	DOE revised Section 1.6 of the final EA to reflect the date the draft EA was provided to the host states and host tribes for review. In addition, DOE included copies of the notification letters and e-mails sent to host states and host tribes in Appendix B of the final EA (i.e., examples of the form letters and e-mails).
18	**Kentucky Energy and Environment Cabinet (Kentucky Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section)**: Page 11, Section 2.1, Proposed Action: "Waste generated during deactivation of Paducah Site facilities would be conducted under DOE's authority and would not be generated from a CERCLA action. The wastes from the Proposed Action could be generated from any of the approximately 600 PGDP facilities[5] (Figure 3) (FRNP 2019b)." Footnote "5 [a]s stated in Section 1.3, the facilities used for the conversion of DUF6 to DU oxide are not included in this EA." The statement that "wastes from the Proposed Action could be generated from any of the approximately 600 PGDP facilities" is confusing and does not appear to coincide with figure 3. It also appears to be making the statement that waste can be generated from deactivation activities from every facility at the Paducah Site. Figure 3 includes all facilities, some of which will not be deactivated under DOE authority (ex. Burial grounds). This Environmental Assessment is specified to cover "a 12-year period." The current scope of planned deactivation activities, over the next 12 years, does not encompass all ~600 PGDP facilities. Revise the "600 PGDP facilities" to include a number that better reflects planned activities over the next 12 years.	DOE acknowledges that all 600 facilities at the Paducah Site will not be deactivated during the 12-year period of the Proposed Action; however, the statement was meant to reference wastes that could be generated from any of the facilities that DOE deactivates during the 12-year period. To clarify that the focus of the deactivation is on buildings and structures and to eliminate land areas and other facilities, such as the Depleted Uranium Hexafluoride Conversion facilities that will not be deactivated as part of the Proposed Action, DOE has revised Section 2.1 to state "…any of approximately 480 PGDP buildings and structures…." DOE also has added in Section 2.1 that, due to changes in funding levels and priorities, the list of facilities could change periodically during the 12-year period. As a result, DOE cannot provide a definitive list of specific facilities in the EA. DOE will evaluate the need for further NEPA analysis based on changes over the life of the Proposed Action.

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19	**Kentucky Energy and Environment Cabinet (Kentucky Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section)**: Page 13, Section 2.1, Proposed Action: "The potential volumes of other refrigerants at the Paducah Site are insignificant compared to the R-114 volume and are considered to be part of the excess R-114 for purposes of this evaluation." What volume is considered to be insignificant in relation to the R-114 quantity?	Other refrigerants at the Paducah Site represent less than 0.05% of the R-114 volume. DOE revised Section 2.1 of the final EA to clarify the volume of other refrigerants in the referenced statement.
20	**Kentucky Energy and Environment Cabinet (Kentucky Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section)**: Page 37, Section 3.2.1.2.2.1, Area off-site population: "The Nearby residences mostly lie along Kentucky Highway 996, which is about 1 mile east of and generally parallel to the eastern edge of the site." Please correct the typo "lie" to "live."	DOE believes "lie" is the appropriate verb for residences.
21	**Kentucky Energy and Environment Cabinet (Kentucky Hazardous Waste Branch, Paducah Gaseous Diffusion Plant Section)**: Section 4.1.1.3.1, Page 57, Impacts from large loss of confinement accident at C-746-Q: This section only mentions earthquakes as being an impact for a large loss of confinement at the C-746-Q Facility. The impacts of a tornado / high winds should also be assessed. If a strong earthquake happened, structures would fall where they stand and airborne contamination would be minimal. If an EF4 to EF5 tornado hits, catastrophic damage could occur, and debris and airborne contaminants could be blown for miles. The reviewer believes that a powerful tornado is the likeliest thing that could result catastrophic failures of various sorts of	The *Emergency Planning Hazards Assessment for the U.S. Department of Energy Paducah, Kentucky Site* (EPHA), which is cited in Section 4.1.1.3.1 of the draft EA, analyzes the impacts from different accident scenarios that could result in potential impacts to the site and surrounding community. These scenarios have several different factors that go into calculating the potential impacts. The EPHA accident scenario described in the EA is a large Loss of Confinement (LOC) from the C-746-Q waste facility, which is initiated by a natural phenomenon event postulated as being seismic in nature. Although a seismic event was the chosen initiator for the large LOC at C-746-Q, the EPHA notes that other natural phenomenon, such as a tornado, could cause a large LOC with similar results. The EPHA (and the EA) evaluated the impacts from a scenario in which the C-746-Q facility is breached from a natural phenomenon event, and all waste containers in the facility are impacted. DOE acknowledges that a tornado potentially could

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21 (Continued)	containment and potentially spread contamination over a large area.	disperse contamination over a larger area, but due to the unpredictable nature of tornados and resulting highly variable potential impacts, the evaluated large LOC accident was based on a seismic natural phenomenon, which results in more localized (and greater, due to less potential dispersion) potential impacts. DOE considered initiating events from other natural phenomena, such as a tornado, for the accident evaluation in the EA, but the potential risk impacts were considered to be bounded by the large LOC resulting from a natural phenomenon seismic event.
22	**Kentucky Energy and Environment Cabinet (Kentucky Division for Air Quality)**: 401 KAR 63:010, Fugitive Emissions, states that no person shall cause, suffer, or allow any material to be handled, processed, transported, or stored without taking reasonable precaution to prevent particulate matter from becoming airborne. Additional requirements include the covering of open bodied trucks, operating outside the work area transporting materials likely to become airborne, and that no one shall allow earth or other material being transported by truck or earth-moving equipment to be deposited onto a paved street or roadway. Please note the Fugitive Emissions Fact Sheet located at https://eec.ky.gov/Environmental-Protection/Air/Documents/Fugitive%20Dust%20Fact%20Sheet.pdf 401 KAR 63:005 states that open burning shall be prohibited except as specifically provided. Open Burning is defined as the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the outdoor atmosphere without passing through a stack or chimney. However, open burning may be utilized for the expressed purposes listed on the Open Burning Brochure located at https://eec.ky.gov/Environmental-Protection/Air/Pages/Open-Burning.aspx	DOE will follow all applicable laws and regulations for the Proposed Action, including the on-site and off-site waste transportation activities. Based on use of standard transportation modes and routes, which are regulated at the federal and state level, DOE is not aware of any local government regulations that would be applicable to the transportation modes and routes that are part of the Proposed Action. In addition, the Paducah Site complies with standard air quality control practices, such as those suggested by the Division, to the extent practicable, to reduce air emissions and will continue to do so in the future. DOE has added a statement to this effect in Section 4.3 of the EA. No open burning is conducted or planned at the Paducah Site.

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22 (Continued)	The Division would like to offer the following suggestions on how this project can help us stay in compliance with the NAAQS. These air quality control strategies are beneficial to the health of citizens of Kentucky. □ Utilize alternatively fueled equipment. □ Utilize other emission controls that are applicable to your equipment. □ Reduce idling time on equipment. The Division also suggests an investigation into compliance with applicable local government regulations.	
23	**Kentucky Energy and Environment Cabinet (Kentucky Nature Preserves):** Your project might have the potential of impacting federally or state listed species and natural communities. Go to the Kentucky Biological Assessment Tool (kynaturepreserves.org) to obtain a Standard Occurrence Report for information regarding listed species known within your project area. The report will also provide information on public and private conservation lands, areas of biodiversity significance, and other natural resources in your project area for which the Office of Kentucky Nature Preserves maintains data.	DOE evaluated information from the Office of Kentucky Nature Preserves, along with information from other resources, which included the U.S. Fish and Wildlife Service and Kentucky Department of Fish and Wildlife Resources, to identify and assess species and biological information for the project area. DOE included a list of rare plant species in McCracken County obtained from the Office of Kentucky Nature Preserves in Appendix C, Table C.3, of the draft EA. DOE determined that impacts to ecological resources would be "negligible" (refer to Section 3.1, "Subject Areas Considered but Dismissed from Detailed Analysis," Table 5, of the EA).
24	**Kentucky Energy and Environment Cabinet:** The Department for Environmental Protection recommends comments be obtained from the Cabinet for Health and Family Services Radiation Health Branch, and the Kentucky Transportation Cabinet based upon the contents of this project.	DOE submitted the draft EA to the Kentucky State e-Clearinghouse and Kentucky Governor's office for review. According to the Kentucky State e-Clearinghouse, the Kentucky State e-Clearinghouse is the official designated Single Point of Contact (SPOC) for the Commonwealth pursuant to Presidential Executive Order 12372, and supported by Kentucky Statutes *KRS* 45.031. The Kentucky State e-Clearinghouse stated in their response that the draft EA was reviewed by the appropriate state agencies.

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25	**Washington State Department of Ecology:** The footnote on page 1 refers to a 2006 a moratorium on shipping LLW and MLLW to Hanford until DOE completed the Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS) for the Hanford Site. Ecology requests that your final EA include reference to the later Record of Decision (ROD) published in the Federal Register (78 FR 240, pages 75913 – 75919) that extends the waste moratorium at least until operations of the Hanford Waste Treatment Plant. That ROD provides: "As stated in the Final TC&WM EIS, DOE would continue to defer the importation of off-site waste at Hanford, at least until the WTP is operational. Any future decision to import off-site waste will be subject to appropriate NEPA review."	DOE has incorporated the language below into the footnote on page 1 of the final EA and footnote b to Table 2. Per a 2013 Record of Decision, "As stated in the Final Tank Closure and Waste Management Environmental Impact Statement (EIS), DOE would continue to defer the importation of off-site waste at the Hanford Site, at least until the Waste Treatment Plant is operational. Any future decision to import off-site waste will be subject to appropriate NEPA review." (78 *FR* 75913, DOE 2013). Note that Perma-Fix Northwest is a privately owned treatment facility, not located at the Hanford Site. The provisions of the Settlement Agreement and the ROD limitations against importation of waste to the Hanford Site do not apply to Perma-Fix Northwest.
26	**Washington State Department of Ecology:** Perma-Fix applied for a new mixed waste permit because Ecology regulations require a new application/permit after a term of 10 years. The State Environmental Policy Act (SEPA, Washington Administrative Code 197-11) requires Ecology to evaluate potential adverse environmental impacts before issuing the new permit. When we begin public comment on our draft SEPA evaluation, Ecology will transmit a copy to you for your consideration.	DOE appreciates the opportunity to review Ecology's draft SEPA.
27	**EPA Region 4:** The EPA recommends that the FEA include updated information regarding applicable National Ambient Air Quality Standards, and Water Quality Standards due to the lapse in time since the PEIS was released.	DOE used current National Ambient Air Quality Standards for calculation of air emissions discussed in the draft EA and did not rely on calculations included in the Programmatic Environmental Impact Statement (PEIS). Similarly, other current environmental standards were considered in the analyses in the draft EA, rather than those in effect at the time of the PEIS. As a result, these analyses do not require updating for the final EA.

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28	**Arkansas Department of Transportation:** All motor carriers transporting must be in compliance with the Federal motor carrier Safety regulations, hazardous material regulations, and any applicable permits surrounding the transportation of hazardous waste. For any loads that fall within the levels of a "radioactive" material which qualifies them as a "reportable quantity", (HMSR's) a Level VI inspection will be required at the port of origin (Kentucky) before travel begins.	Text has been added to Section 3.2.2.1 of the final EA, acknowledging that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations. DOE believes the commenter is referring to the Level VI inspection required for a "Highway Route Controlled Quantity" (HRCQ; 49 *CFR* 173.403). The Paducah Site does not have activity levels in radioactive materials that would meet the criteria for HRCQ. The majority of all waste or equipment from the Paducah Site would be within the range for a Type A Quantity (49 *CFR* 173.403). An HRCQ is greater than 3,000 times a Type A Quantity or greater than 1,000 terabecquerel (TBq). An HRCQ waste would not be generated or shipped from the Paducah Site. "Reportable Quantities" are U.S. Environmental Protection Agency (EPA) thresholds that may be exceeded for some, but not all, shipments of radioactive material from the Paducah Site. Reportable quantity shipments are not the same as HRCQ shipments and do not require a Level VI inspection at the point of origin, unless the shipment also is an HRCQ.
29	**Tennessee Department of Environment and Conservation:** TDEC's Division of Radiological Health regulates several radioactive waste processors in the State, including DSSI and EnergySolutions. These facilities are operated in accordance with standards required by the Nuclear Regulatory Commission, Tennessee's State Regulations for Protection Against Radiation, as well as requirements specified in their respective radioactive material licenses issued by TDEC. These standards and requirements apply to all radioactive waste received, including waste received from the Paducah Gaseous Diffusion Plant. Additionally, DSSI and EnergySolutions are also permitted facilities through TDEC's Division of Solid Waste Management and are operated in accordance with federal and state hazardous waste management rules and regulations. TDEC encourages DOE to reflect that both facilities are regulated by TDEC in the Final EA.	The treatment and disposal facilities identified in the draft EA are existing facilities that have the necessary licenses and/or permits to accept the waste that will be generated at the Paducah Site. DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements (refer to Section 4.1 of the EA). Because the applicable licenses and permits under which each facility identified in the Proposed Action currently operates could change during the period of the Proposed Action, DOE has not included a list of the licenses and permits or regulating entities in the EA.

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30	**Missouri Department of Natural Resources:** Section 3.2.2.1 does not currently discuss radioactive material shipment fees. Some states, including Missouri, have statutes stating that certain shipments of radioactive materials are subject to a fee when traveling in or through the state. The EA should acknowledge these fees and include a discussion on if shipment fees would impact the treatment and disposal facilities chosen.	For each truck or rail shipment of Low-level Radioactive Waste traveling in or through the state of Missouri, the Paducah Site will complete Form, MO 780-2146, Missouri Low-Level Radioactive Waste Shipment Form, and pay the appropriate fees as described in RSMo 260.392.1. DOE also added a statement in Section 3.2.2.1 of the final EA that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations. Shipment fees, although one of a number of factors considered in the selection of the treatment and/or disposal facility chosen for a particular waste shipment, are not expected to be a significant factor in the decision process.
31	**Missouri Department of Natural Resources:** In Section 3.2.2.1.1, DOE should include a discussion on identifying what portion of the waste, if any, will be classified as highway route controlled radioactive waste. As well as a discussion of why the state-preferred routes for highway route controlled radioactive waste were chosen for these shipments.	Text has been added to Section 3.2.2.1 of the final EA, acknowledging that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations. The Paducah Site does not have activity levels in radioactive materials that would meet the criteria for HRCQ. The majority of all waste or equipment from the Paducah Site would be within the range for a Type A Quantity. An HRCQ is greater than 3,000 times a Type A Quantity or greater than 1,000 TBq. An HRCQ waste would not be generated or shipped from the Paducah Site. As requested, DOE has clarified in Section 3.2.2.1 of the final EA that waste meeting the criteria for HRCQ will not be generated or shipped from the Paducah Site as part of the Proposed Action. The proposed transportation routes provided in the EA are representative routes chosen for analysis (refer to Section 3.2.2.1.1). The actual transportation route selected at the time of shipment may vary from the representative route shown in the EA.

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32	**Missouri Department of Natural Resources:** Section 3.2.2.1.1 does not currently address radiological or truck safety inspections of the waste. Some states, including Missouri, have statutes that allow for inspections on shipments that exceed a certain level of radioactivity. The EA should include a discussion of how inspections would occur during transit, and how the site will coordinate with states that perform inspections.	Text has been added to Section 3.2.2.1 of the final EA, acknowledging that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations. DOE believes that the inspection the commenter is referring to is the Level VI inspection required for an HRCQ. The Paducah Site does not have activity levels in radioactive materials that would meet the criteria for HRCQ. The majority of all waste or equipment from the Paducah Site would be within the range for a Type A Quantity. An HRCQ is greater than 3,000 times a Type A Quantity or greater than 1,000 TBq. DOE has clarified in Section 3.2.2.1 of the final EA that HRCQ waste would not be generated or shipped from the Paducah Site as part of the Proposed Action; therefore, the Level VI inspections would not be required. DOE also has added clarification in Section 3.2.2.1 to state that DOE will comply with applicable state requirements when shipping radioactive materials through states with radioactive material shipment statutes and/or regulations.
33	**Pennsylvania Department of Environmental Protection:** Table 4 of the Draft EA, titled *Potential Treatment and Disposal Facilities for Waste Types from the Paducah Site and Transport Modes from the Paducah Site to Each Facility* identifies Evoqua Water Technologies (Evoqua), as one of six potential facilities that may receive and treat the nonradioactive RCRA-hazardous waste. Page 2 of the Draft EA states, "All waste disposition actions will comply with the licenses, permits, and/or approvals applicable to the facilities described in this EA." Although the amount of waste that may be transported to Evoqua from the Paducah site is less than 1% of the total amount of waste estimated to be generated as a result of the	DOE acknowledges the Pennsylvania Department of Environmental Protection's (PADEP's) comments. As noted by PADEP, prior to shipping any wastes off-site, DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements. In Section 4.1 of the final EA, DOE has added that the Paducah Site also complies with DOE and site-specific radiological control procedures for the release of materials off-site, including wastes and excess equipment, to ensure that radiologically contaminated materials are not released to facilities that are not authorized to receive radiological materials.

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33 (Continued)	decommissioning activities, PADEP would like to provide comments concerning Evoqua's operating requirements that are imposed by permits issued to Evoqua by PADEP, and the relationship between those operating requirements and DOE's Draft EA. **Solid Waste Permit No. PAD87270725** Evoqua is a carbon reactivation facility located in Darlington, PA, approximately 45 miles Northwest of Pittsburgh. The facility has been operating since 1997 under various names and company ownership, and it predominantly treats spent activated carbon in a rotary kiln system for reuse. The facility operates under solid waste permit No. PAD87270725, issued by PADEP, which authorizes the storage of RCRA-hazardous waste and the treatment/processing of residual waste, as the term is defined by Pennsylvania's residual waste regulations, 25 Pa. Code §287.1. Specifically, Evoqua is authorized to store and process spent carbon, sorbents and catalysts in containers or tanks pending thermal treatment recycling in rotary kilns. This facility is not a hazardous waste disposal facility. Solid waste permit No. PAD87270725 expires on May 15, 2023, unless Evoqua applies for renewal. In accordance with solid waste permit No. PAD87270725, and Pennsylvania's waste regulations, Evoqua's Waste Acceptance Plan identifies criteria for waste accepted at the facility. Therefore, any	

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33 (Continued)	waste proposed for treatment at Evoqua must first be characterized to determine whether it can be treated at the facility in accordance with the approved Waste Acceptance Plan. Analyses performed to characterize the waste must also be submitted to PADEP, and written approval given for each waste stream prior to acceptance at Evoqua. PADEP refers to this submission as a Module 1. The RCRA-hazardous waste from the Paducah site requires approval through the Module 1 process prior to being shipped to Evoqua. Solid waste permit No. PAD987270725 also requires Evoqua to have a Radiation Protection Action Plan (RPAP) and to monitor incoming waste for radioactivity in accordance with its approved RPAP. Evoqua's current RPAP may not be able to detect certain radioactive isotopes that may be contained in the RCRA-hazardous waste from the Paducah site, such as natural uranium (U-nat), enriched uranium (EU), depleted uranium (DU), transuranic waste (TRU) or Technetium-99 (Tc-99). The Draft EA does not address any procedures that may be in place at the Paducah site that ensure RCRA-hazardous waste does not also contain radioactive contamination. Solid waste permit No. PAD8720725 limits the amount of truck traffic that may enter the Evoqua facility to a maximum of 20 trucks per day. While the EA states that two shipments per day are expected from the Paducah site, shipments destined for Evoqua must be scheduled in advance to ensure compliance with Evoqua's permit and ensure that	

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33 (Continued)	the maximum volume of 20 trucks per day is not exceeded. **Air Quality State Only Operating Permit No. 04-00443** Evoqua operates under air permit No. 04-00443, issued by PADEP, which expires on September 6, 2024, unless renewed. There are several conditions in the air permit that limit the type and quality of materials processed. PADEP requires additional information on the waste being proposed for treatment at Evoqua, and the identification or quantity of expected pollutants, to evaluate the impact on air permit No. 04-00443. PADEP notes the following conditions of air permit No. 04-00443: 1. Condition Section C #008: The permittee shall not process any sorbent that is not allowed according to Waste Management ID No. PAD987270725 or as otherwise directed by the Department's Waste Management Program. 2. Condition Section C #015: During the waste approval process and prior to acceptance, the permittee shall screen spent sorbents used in a process where sorbent influent has shown the presence of polychlorinated biphenyl (PCB), sulfur, or dioxins and furans for those associated constituents. The permittee shall not process any spent sorbents that exceed the allowable limits in this permit or by Waste Management Permit PAD987270725. PADEP is reassured that the Evoqua permit requirements will be met since page 51 of the EA states "Prior to shipping any wastes off-site, DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements."	

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34	**Nevada Division of Environmental Protection:** 1. **A significant conflict exists between the timeframes covered by the Draft PGDP EA and the *Final Site-Wide Environmental Impact Statement for the Continued Operation for the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada, February 2013 " (DOE/EIS-0426)*** (NV SWEIS)**.** The Draft PGDP EA states in the beginning of Section **1.5, SCOPE OF THIS ASSESSMENT**, "This EA evaluates the potential effects of management and disposition of deactivation and other non-CERCLA waste and materials generated at the Paducah Site from an approximate 12-year period beginning in fiscal year (FY) 2020…The approximate 12-year time period corresponds to the duration during which deactivation activities are anticipated to be performed to prepare for future demolition activities at the site. The amounts and various waste types proposed for off-site treatment and disposal from the Paducah Site are presented in Section 2.1, along with waste transportation options and locations being proposed for off-site waste treatment and disposal."	DOE acknowledges Nevada Division of Environmental Protection's comment and will consider the need for further NEPA analysis of the 2013 NV SWEIS, as appropriate, to meet DOE's ongoing waste disposition needs.

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34 (Continued)	Table 4 in Section **2.1, PROPOSED ACTION** of the Draft PGDP EA "lists the off-site DOE and commercial facilities being considered for treatment and/or disposal of LLW, MLLW, and nonradioactive RCRA wastes, and for destruction of the R-114 wastes (if necessary) from the Paducah Site under this EA." The Nevada National Security Site (NNSS) in Mercury, NV is listed as being a potential site for the disposal of LLW and MLLW that would be transported via highway from the PDGP. Any needed treatment of the waste would be completed at another permitted facility before disposal at the NNSS. The DOE issued the NV SWEIS on February 22, 2013 and the Record of Decision for *The Continued Operation for the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* was published in the Federal Register on December 30, 2014 (ROD). The beginning of Section 1.1, **Introduction**, of the NV SWEIS states, "This site-wide environmental impact statement (SWEIS) analyzes the potential environmental impacts of reasonable alternatives for current and reasonably foreseeable missions, programs, capabilities, and projects at the NNSS and offsite locations in Nevada during a 10-year period." **The State of Nevada recommends that the process for reanalysis of the NV SWEIS begin as soon as possible as the DOE will need to conduct further NEPA analysis of any continued use of the NNSS for disposal of waste from the PGDP past the timeframes covered by the 2013 NV SWEIS.**	

Comment Number	Comment	Response
35	**Nevada Division of Environmental Protection:** 2. **It is not clear if all of the approximately 5,050,000 cubic feet (ft3) of waste and excess material covered in the PGDP EA is actually destined for the NNSS for disposal when compared to Table A-6 of the NV SWEIS.** Table A-6 of the NV SWEIS, Waste Generators and Volumes Under the Expanded Operations Alternative, lists the Paducah Gaseous Diffusion Plant as shipping 5,100,100 cubic feet of LLW and 1,500,000 cubic feet of MLLW to the NNSS over the period covered by NV SWEIS. The first footnote for Table A-6 does state that "actual individual waste volumes by generator may be more or less than presented in the table…," **As such, please specify how much of the 5,100,100 cubic feet of LLW and 1,500,000 cubic feet of MLLW from the PGDP is actually destined for the NNSS and what volumes of LLW, MLLW, non-rad hazardous and classified wastes will be disposed of in Nevada. If these decisions have not yet been made, please indicate how and when will they be made and by whom.**	At the time the NV SWEIS was prepared, DOE used the best available information, which indicated that 5,100,100 ft^3 of LLW and 1,500,000 ft^3 of MLLW from PGDP would be disposed of at NNSS over the 10-year time period of the SWEIS. A large portion of the wastes from PGDP that were included in the NV SWEIS was expected to be generated from the Depleted Uranium Hexafluoride Conversion Project, which is a separate project at the Paducah Site from the proposed project that is the subject of the draft EA. Further discussion of the NV SWEIS is outside the scope of this EA. As wastes are generated at PGDP and characterized for treatment and/or disposal, the Paducah Site Deactivation and Remediation Contractor, in conjunction with DOE, will make the decisions regarding which facility to ship the waste to for treatment and/or disposal. These decisions will be based on many factors, including but not limited to, the following: facility waste acceptance criteria; any security limitation on facilities to which certain waste can be shipped for disposal; technical requirements for material handling; and overall cost comparisons.

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36	**Nevada Division of Environmental Protection:** 3. **Nevada wants to ensure that all the other potential disposal sites evaluated in the PGDP EA, including on-site disposal at the PGPD site, are equally considered for disposal of the 5,100,100 cubic feet of LLW and 1,500,000 cubic feet of MLLW from the PGDP. The Environmental Management Program of the DOE has been in existence for three decades. Site-specific studies and technical analyses at the PGDP site to locate and construct suitable on-site disposal facilities could have been accomplished during this time. The availability of off-site disposal facilities should not be an automatic default and reason to dismiss this possible disposal alternative as is done in Section 2.3.3 of the PGDP EA. Please include specific details of what portion of the 5,050,000 cubic feet (ft^3) of waste and excess material meets the current criteria for onsite disposal at the PGDP.**	None of the 5,050,000 ft^3 of waste included in the Proposed Action is proposed for on-site disposal at the Paducah Site (refer to Section 2.1 and Table 2 of the EA). Although DOE owns and operates an on-site landfill for disposal of nonhazardous solid waste, none of the 5,050,000 ft^3 of waste in the Proposed Action would meet the waste acceptance criteria for disposal in the on-site landfill.
37	**Nevada Division of Environmental Protection:** 4. **All LLW, MLLW, non-radiologically contaminated hazardous and classified waste and excess material disposed of at the NNSS must meet all criteria established in NDEP-issued permits and the NNSS Waste Acceptance Criteria (NNSS WAC). Please include specific information on the physical and radiological characteristics of the 5,100,100 cubic feet of LLW and 1,500,000 cubic feet of MLLW from the PGDP, including the anticipated upper limits of activity for all radionuclides, to ensure that all waste destined for the NNSS will meet the requirements of NDEP-issued permits and the NNSS WAC.**	Prior to shipping any wastes off-site, DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements (refer to Section 4.1 of the EA). The LLW/MLLW large components, which is the waste stream most likely to be disposed of at NNSS, are expected to be Class A Low-Level Radioactive Waste, as defined at 10 *CFR* 61.55, and will be shipped under Paducah's NNSS Profile, PGDP-PAD000005, Special Waste Debris, which contains the upper limits of activity for the waste stream. A copy of NNSS waste profile should be available to NDEP as a member of the Waste Acceptance Review Panel, which approves all NNSS waste profiles.

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38	**Nevada Division of Environmental Protection:** 5. **PCB waste or excess material that is disposed of at the NNSS must meet the conditions of NDEP-issued RCRA and Solid Waste permits. Please clarify whether any of the waste destined for the NNSS contains PCBs, is considered Bulk PCB Product or PCB Remediation Waste. If the waste or excess material does contain any of these types of PCBs, please specify the volume in each category.**	None of the waste that is anticipated to be generated as part of the Proposed Action is considered to be PCB Bulk Product or PCB Remediation Waste. Some of the MLLW liquids, MLLW solids, or nonradioactive RCRA-hazardous wastes listed in Table 2 of the draft EA, however, could contain PCBs along with the hazardous constituents, but these waste streams are not expected to be shipped to the NNSS for disposal.
39	**Nevada Division of Environmental Protection:** 6. **The NDEP-issued RCRA permit only allows specific hazardous waste codes. Please specify what types of RCRA waste (i.e., specific hazardous waste codes) are expected to be in the 1,500,000 cubic feet of MLLW from the PGDP.**	Prior to shipping any wastes off-site, DOE will follow all required waste acceptance processes for each treatment and/or disposal facility to confirm acceptability that each waste shipment meets waste acceptance criteria and other applicable license and permit requirements (refer to Section 4.1 of the EA). Only MLLW meeting LDR treatment standards, the NNSS permit requirements, and waste acceptance criteria would be shipped to NNSS. As stated in the response to Comment 37, the LLW/MLLW large components, which is the waste stream most likely to be disposed of at NNSS, are expected to be Class A Low-Level Radioactive Waste, as defined at 10 *CFR* 61.55, and are not expected to be MLLW based on available *in situ* characterization data. The LLW waste anticipated to be shipped to NNSS is expected to be shipped under Paducah's NNSS Profile, PGDP-PAD000005, Special Waste Debris, a copy of which should be available to NDEP as a member of the Waste Acceptance Review Panel, which approves all NNSS waste profiles.

Comment Number	Comment	Response
40	**Nevada Division of Environmental Protection:** 7. **Section 1.3.3, Purpose and Need for Action, of the PGDP states that, "DOE's purpose for the Proposed Action is to ensure safe, efficient, and compliant management and disposition of waste and material generated from deactivation and other non-CERCLA activities at the Paducah Site in a cost-effective manner as required under federal and state regulations and DOE Orders." and "This EA does not address waste and material generated as part of an action taken under CERCLA." Please describe what safeguards DOE has in place to ensure no CERCLA waste is shipped to the NNSS.**	The wastes that will be generated as part of the Proposed Action will not be generated from a CERCLA action. This EA does not preclude future decisions on CERCLA waste disposal, which result from the CERCLA process. As described in Section 1.3, NEPA values for waste and material generated as part of a CERCLA action are addressed in project-specific CERCLA documents. CERCLA waste generated at the Paducah Site is linked to the CERCLA project/action from which it is generated and tracked via the Paducah Site's waste information tracking system from generation through disposition. Prior to shipping any waste off-site for disposition, all available on-site data associated with the waste are reviewed to determine that appropriate disposition has been identified and that the waste meets all applicable waste acceptance criteria and licenses and permits of the receiving facility.
41	**Nevada Division of Environmental Protection:** 8. **Section D.2., Proposed Action, states, "Large components being shipped as LLW or MLLW would constitute approximately 76% of the total waste volume. These large components primarily would ship as intact items;…" Please describe how intact Mixed Low-Level Waste large components will be treated to meet LDR standards. Also, please include information on special DOE permitting that would be required to ship the LLW/MLLW large components considered oversized loads.**	DOE expects the vast majority, if not all, of the large components that are part of the Proposed Action to be Class A LLW, and not MLLW, based on *in situ* characterization data that is available. If a large component is characterized as MLLW, the large component would have to be evaluated to determine appropriate treatment and shipment options. DOE's Motor Carrier Evaluation Program-approved carriers, which are the only carriers used for waste shipments from the Paducah Site, obtain the appropriate Over-Dimensional and Over-Weight Permits from each state that the oversized loads would travel through. As part of the permit process, the states inform the carriers what route must be used through the state. No "DOE" permitting is applicable for oversized loads.

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42	**Nevada Division of Environmental Protection:** 9. **Page 8, Section 1.5.4, First Paragraph states, ". ... *A small percentage (approximately 10% or 9,000 ft^3; see Section 2.1) of the R-114 is anticipated to have radioactive contamination levels above DOE authorized limits and require management and disposition as LLW*…" If this percentage of R-114 waste is going to be disposed of as LLW at the NNSS, please describe where and how it will be treated prior to disposal. The disposal of R-114 waste at the NNSS is <u>not</u> addressed in the NV SWEIS and would need to be included in any updated NEPA analysis (see Comment No. 1).**	DOE acknowledges that disposal of R-114 waste at the NNSS is not addressed in the NV SWEIS. R-114 from the Paducah Site is not designated for disposal at NNSS (refer to Table 4 in Section 2.1 of the EA).
43	**Nevada Division of Environmental Protection:** 10. **If any of the 5,050,000 cubic feet (ft^3) of waste and excess material has already been generated, dispositioned and/or disposed of at the NNSS, please indicate what portion and type(s) of waste and excess material has been disposed of to date and explain why was it shipped prior to the finalization of the PGDP EA.**	DOE has not generated or sent any waste or excess material to NNSS that is included in the 5,050,000 ft^3 of waste that is the subject of the Proposed Action.
44	**North Carolina Department of Environmental Quality:** The Department of Environmental Quality has reviewed the proposal for the referenced project. Based on the information provided, several of our agencies have identified permits that may be required. Due to insufficient information, the NC Wildlife Resources Commission (NCWRC) staff could not make definitive	All waste disposition actions that are part of the Proposed Action will comply with the licenses, permits, and/or approvals applicable to the treatment and disposal facilities described in this EA (refer to Section 1.1 of the EA). In addition, DOE will comply with applicable federal and state regulations for the activities that are part of the Proposed Action. Potential impacts at off-site treatment and disposal facilities were considered as part of the licensing/permitting/approval process for the off-site treatment

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44 (Continued)	recommendations or conclusions concerning the potential impact from the treatment and disposal of waste and excess material at the Clean Harbors Facility in Reidsville, NC. An on-site survey is the only means to determine if the proposed project may impact federal or state rare, threatened, or endangered species. The applicant should contact Olivia Munzer, Western Piedmont Coordinator Habitat Conservation with NCWRC for guidance. The comments are attached for the applicant's review. The Department agencies will continue to be available to assist the applicant through any environmental review or permitting processes. Thank you for the opportunity to respond.	and disposal facilities. Impacts at the off-site facilities, therefore, are not addressed in the EA (refer to Section 1.1 of the EA). Refer to the response to Comment 45 for the response to the comment from the NCWRC.
45	**North Carolina Wildlife Resources Commission:** Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the subject information. Our comments are provided in accordance with provisions of the United States National Environmental Policy Act and Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The U.S. Department of Energy Portsmouth/Paducah has prepared a draft environmental assessment (EA) for the disposition of approximately 5,050,000 cubic feet of waste and excess material to support deactivation and other non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) USDOE Environmental Management activities at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky. The disposal and treatment of	Potential impacts at off-site treatment and disposal facilities, including the Clean Harbors facility in Reidsville, North Carolina, were considered as part of the licensing/permitting/approval process for the off-site treatment and disposal facilities. Impacts at the off-site facilities, therefore, are not addressed in the EA (refer to Section 1.1 of the EA).

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45 (Continued)	waste is proposed to occur at several facilities, including the Clean Harbors facility located at 208 Watlington Industrial Drive in Reidsville, North Carolina. The Clean Harbors facility would accept nonradioactive Resource Conservation and Recovery Act (RCRA)-hazardous waste, and the waste would be transported via highway. Unnamed tributaries to the Little Troublesome Creek in the Cape Fear River basin drain the area near the Clean Harbors facility. We have no records of federal or state protected species occurring at or adjacent to the site; however, the lack of records from the site does not imply or confirm the absence of federal or state-listed species. An on-site survey is the only means to determine if the proposed project may impact federal or state rare, threatened, or endangered species. At this time, the information provided is not sufficient for our staff to make definitive recommendations or conclusions concerning the potential impact from the treatment and disposal of waste and excess material at the Clean Harbors Facility in Reidsville, NC on aquatic and terrestrial resources. Thank you for the opportunity to provide input in the early planning stages for this project.	
46	**North Carolina Department of Environmental Quality:** The Hazardous Waste Section has reviewed the disposition of approximately 5,050,000 cubic feet of waste and excess material to support deactivation and other non-Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) in Reidsville, NC and would like to make the following comment: Any hazardous waste generated from the demolition, construction, operation, maintenance, and/or remediation (e.g. excavated soil) from	No "demolition, construction, operation, maintenance, and/or remediation" is planned in the state of North Carolina as part of the Proposed Action. Potential impacts at off-site treatment and disposal facilities, including the Clean Harbors facility in Reidsville, North Carolina, were considered as part of the licensing/permitting/approval process for the off-site treatment and disposal facilities. Impacts at the off-site facilities, therefore, are not addressed in the EA (refer to Section 1.1 of the EA).

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46 (Continued)	the proposed project must be managed in accordance with the North Carolina Hazardous Waste Rules. The demolition, construction, operation, maintenance, and remediation activities conducted will most likely generate a solid waste, and a determination must be made whether it is a hazardous waste. If a project site generates more than 220 pounds of hazardous waste in a calendar month, the HWS must be notified, and the site must comply with the small quantity generator (SQG) requirements. If a project site generates more than 2200 pounds of hazardous waste in a calendar month, the HWS must be notified, and the facility must comply with the large quantity generator (LQG) requirements. Generators are required to determine their generator status and both SQGs & LQGs are required to obtain a site EPA Identification number for the generation of hazardous waste.	

References

Comment 8:
BJC (Bechtel Jacobs Company LLC) 2006. *Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, BJC/PAD-691/R1, Bechtel Jacobs Company LLC, Paducah, KY, March.

Comment 11:
Ewers, R., Duda, A., Estes, E., Idstein, P., & K. Johnson. 1992. The Transmission of Light Hydrocarbon Contaminants in Limestone (Karst) Aquifers. Proceedings from Conference on Hydrogeology, Ecology, Monitoring, and Management of Ground Water in Karst Terranes, National Ground Water Association.

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