DOE/EA-1927

Paducah Gaseous Diffusion Plant Draft Environmental Assessment for Potential Land and Facilities Transfers, McCracken County, Kentucky

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

June 2015

ACRONYMS AND ABBREVIATIONS

CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
dBA	A-weighted decibel
DOE	U.S. Department of Energy
DUF_6	depleted uranium hexafluoride
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FONSI	Finding of No Significant Impact
FR	*Federal Register*
KAR	*Kentucky Administrative Regulations*
Kentucky	Commonwealth of Kentucky
KDFWR	Kentucky Department of Fish and Wildlife Resources
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act of 1969*
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
PED	Paducah Economic Development
PGDP	Paducah Gaseous Diffusion Plant
PM_{10}	particulate matter with aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with aerodynamic diameter of 2.5 micrometers or less
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer
TNT	trinitrotoluene
TVA	Tennessee Valley Authority
USEC	United States Enrichment Corporation
U.S.C.	*United States Code*
WKWMA	West Kentucky Wildlife Management Area

The inside back cover of this EA lists conversion factors for common English and metric units.

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE), Portsmouth/Paducah Project Office

TITLE: *Paducah Gaseous Diffusion Plant Draft Environmental Assessment for Potential Land and Facilities Transfers, McCracken County, Kentucky* (DOE/EA-1927) (EA)

CONTACTS:

For further information on this EA, please contact:

Robert "Buz" Smith
U.S. Department of Energy - Paducah
5501 Hobbs Road C103
Paducah, KY 42053
E-mail: robert.smith@lex.doe.gov
Phone: 270-441-6821

For general information on the DOE *National Environmental Policy Act of 1969* (NEPA) process, please contact:

Carol Borgstrom, Director
Office of NEPA Policy and Compliance, GC-54
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-4600
or leave a message at 1-800-472-2756

ABSTRACT: The U.S. Department of Energy (DOE or the Department) and its predecessors have owned and operated all or parts of the Paducah Gaseous Diffusion Plant (PGDP) site in McCracken County, Kentucky, since 1950. The *Energy Policy Act of 1992* (42 U.S.C. 13201 note) transferred operational responsibility for uranium enrichment to the United States Enrichment Corporation (USEC) in 1993. USEC ceased operations in May 2013 and returned the facilities to DOE control in October 2014. DOE is interested in reducing the footprint of the site, which would reduce the cost to maintain the site. A portion of the community is interested in real property transfer to help offset job losses by attracting businesses to the area and using the land and facilities for potential community reuse. Real property transfers could be by leases, easements, or title transfers that DOE could enter into with federal, Commonwealth of Kentucky (Kentucky), and local governments or private entities.

The Proposed Action DOE is evaluating in this EA is the potential transfer of PGDP real property to one or more entities for uses that could be different from its current use. Remediation of the PGDP site is independent of the Proposed Action described in this document and will be performed regardless of any real property transfer decisions. The DOE Proposed Action would reduce the footprint of the site, which would reduce the cost to maintain the site.

PUBLIC PARTICIPATION: DOE held a public information meeting on Tuesday, March 19, 2013, at the West Kentucky Community and Technical College in Paducah, and about 40 people attended. DOE employees were available for informal discussions during a 1-hour open house before the meeting. The meeting included a formal presentation and a question and answer session. DOE announced the meeting through advertisements in local newspapers, including *The Paducah Sun*, the *West KY News*, and *Lone Oak News/The Good Neighbor*, and in a postcard DOE sent to about 1,500 local residents, elected officials, and other interested parties.

DOE will accept comments on this Draft EA by mail, facsimile, or e-mail for a period of 45 days after publication. Comments should be addressed to Mr. Robert Smith using the contact information above. DOE will consider all comments, to the extent practicable, received by, or that are postmarked by, the close of the comment period in the preparation of the Final EA. After issuing this Draft EA, the Department will hold a public comment meeting during the 45-day formal comment period. The public comment meeting

will be announced via the same process as the initial public information meeting described above. This document is available on DOE's NEPA website at http://energy.gov/nepa/nepa-documents and the Portsmouth/Paducah Project Office website at http://www.energy.gov/pppo/paducah-ea.

TABLE OF CONTENTS

List of Appendixes

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1. INTRODUCTION

1.1 Purpose and Need for Action

The U.S. Department of Energy (DOE or the Department) and its predecessors have owned and operated all or parts of the Paducah Gaseous Diffusion Plant (PGDP) site in McCracken County, Kentucky, since 1950 (Figure 1-1). The *Energy Policy Act of 1992* (42 U.S.C. 13201 note) transferred operational responsibility for uranium enrichment at the PGDP site to the United States Enrichment Corporation (USEC) in 1993. USEC, which operated the plant under a license from the U.S. Nuclear Regulatory Commission (NRC), ceased operations in May 2013 and returned the facilities to DOE control in October 2014. The Proposed Action DOE is evaluating in this *Paducah Gaseous Diffusion Plant Draft Environmental Assessment for Potential Land and Facilities Transfers, McCracken County, Kentucky* (EA; DOE/EA-1927) is the potential transfer of PGDP real property to one or more entities. For this EA, real property is defined as land, together with the improvements, structures, and fixtures located thereon. Remediation of the PGDP site is independent of the Proposed Action described in this document and will be performed regardless of any real property transfer decisions. DOE has prepared this EA pursuant to the *National Environmental Policy Act of 1969* (NEPA; 42 U.S.C. 4321 et seq.).

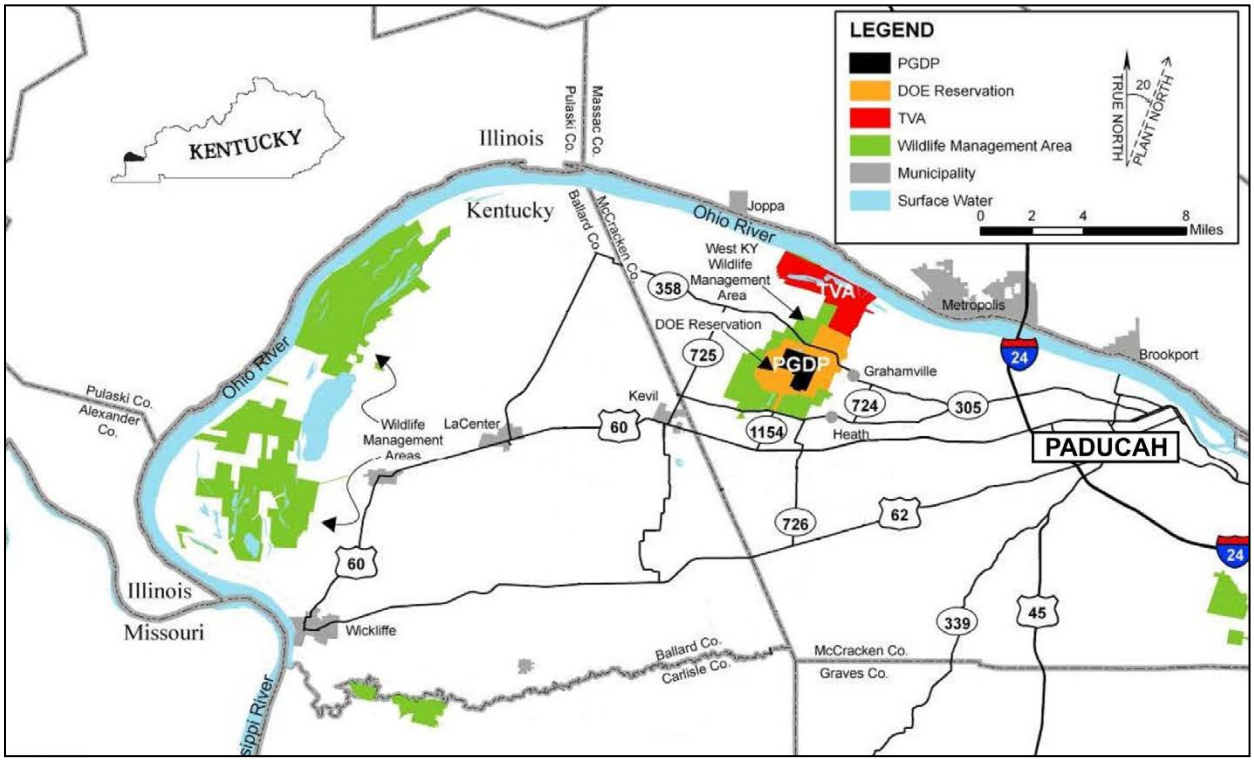


Figure 1-1. Location of the PGDP site (LATA 2012a).

The Purpose and Need for DOE's Proposed Action is to reduce the footprint of the site, which would reduce the cost to maintain the site. A portion of the community is interested in real property transfer to help offset job losses by attracting business to the area and using the land and facilities for potential community reuse.

Real property transfers could include leases, easements, or title transfers that DOE could enter into with federal, Kentucky, and local governments or private entities.

This EA is one part of DOE's potential real property transfer process; among the other parts are compliance with, as applicable, the transfer protocols under Section 120(h) of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA; 42 U.S.C. 9601 et seq.) and with 10 CFR Part 770, "Transfer of Real Property at Defense Nuclear Facilities for Economic Development," and land use control under the DOE-PGDP Federal Facility Agreement (FFA). These items are discussed in Sections 1.3.1, 1.3.2, and 1.3.3, respectively.

Section 1.2 discusses the background of the PGDP site. Section 1.3 describes DOE's responsibilities under CERCLA, including Section 120(h). Section 1.4 describes the advantages of early NEPA analysis, Section 1.5 describes the scope of the EA, and Section 1.6 describes the public participation process. Chapter 2 describes the Proposed Action and No-Action Alternative. Chapter 3 describes the affected environment and potential environmental consequences. Chapter 4 discusses cumulative impacts, and Chapter 5 discusses resource commitments. Chapter 6 lists references. Appendix A summarizes public participation, and Appendix B contains copies of correspondence DOE conducted with other parties about this EA.

1.2 Background

The PGDP site in McCracken County, Kentucky, is about 10 miles west of the City of Paducah and 3.5 miles south of the Ohio River (LATA 2012a). Figure 1-2 shows the approximate boundaries of the site, which includes lands DOE licenses to the Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA).

Before DOE operations, from December 1942 until August 1945, a portion of the site was a part of the former Kentucky Ordnance Works, a World War II explosives manufacturing facility. The PGDP 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 uranium enrichment facilities to USEC, which operated the facilities to produce commercial nuclear reactor fuel. USEC ceased operations in May 2013 and returned the facilities to DOE control in October 2014.

DOE land holdings at the PGDP site encompass 3,556 acres (the blue line in Figure 1-2). The DOE land has a more heavily developed industrial center (referred to in this document as the industrial area) with undeveloped lands around it. The industrial area of the site occupies 1,570 acres consisting of 748 acres inside the security fence (red line) and another 822 acres containing roads, parking lots, grassy areas, utility infrastructure, water impoundments, and some forested lands. The undeveloped land licensed to Kentucky as part of the WKWMA occupies 1,986 acres and contains access roads and multiple rights-of-way for electrical transmission lines but is otherwise a mixture of grass meadows, and areas of diverse vegetation (see Section 3.8). DOE currently licenses this area to Kentucky as part of the WKWMA (yellow line and shading in Figure 1-2), with the exception of a landfill in the northeastern part of the site (see Section 3.2 for more detail) (LATA 2012b).

With uranium enrichment activities having ended, DOE is focusing its resources and efforts at the PGDP site on its mission of environmental management, decontamination and decommissioning, and maintenance of remaining facilities in a safe and regulatory compliant manner.

In addition, DOE is continuing (DOE 2013a):

- Safe management of site infrastructure including buildings and roads;

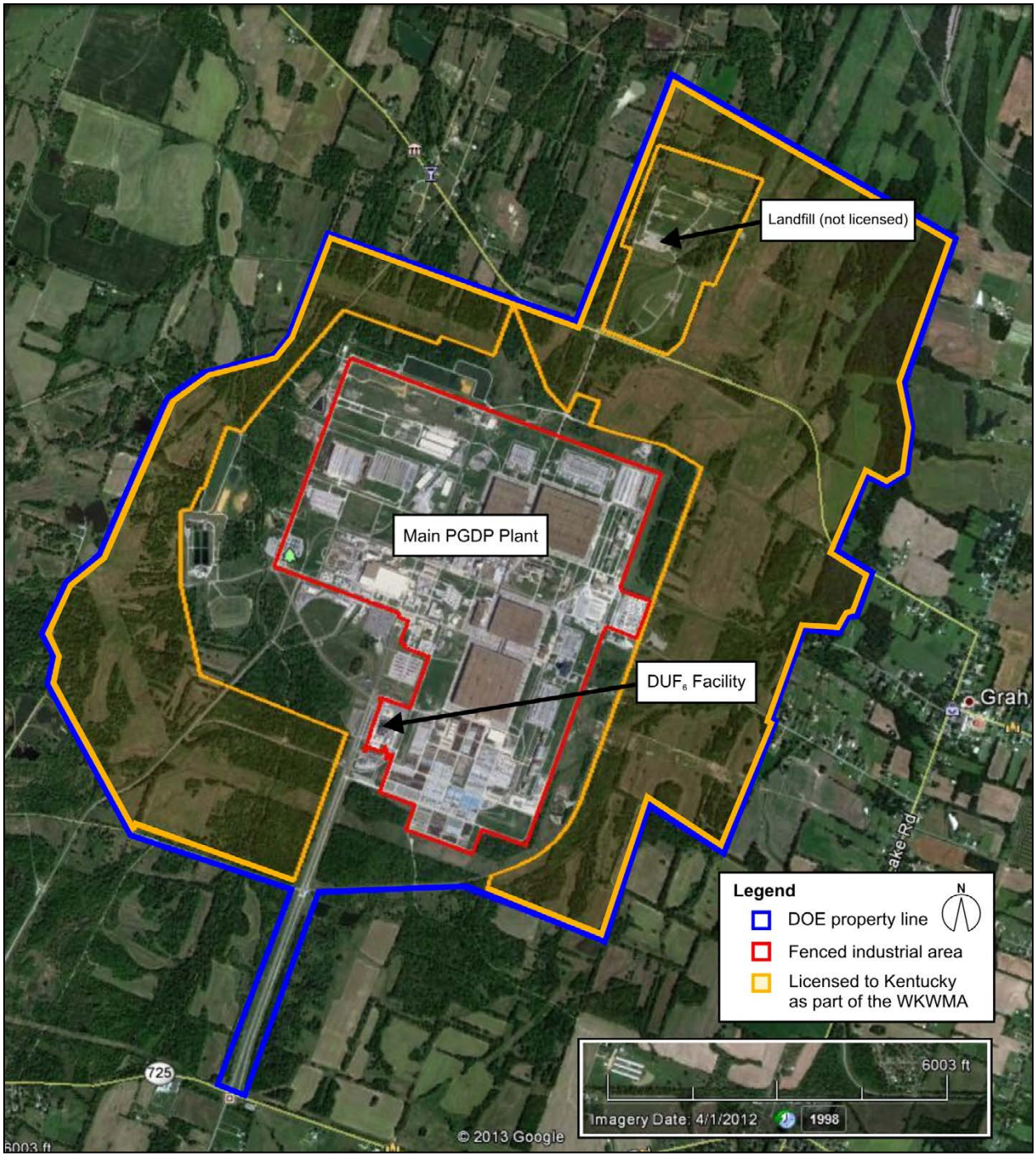


Figure 1-2. Major features of the PGDP site.

- Operation of a waste management program that includes waste from environmental management programs, decontamination and demolition waste, and shipment of waste to appropriate storage, treatment, and disposal facilities; and

- Management of approximately 42,000 cylinders of depleted uranium hexafluoride (DUF_6), which DOE is converting into a more stable form (an oxide) for beneficial reuse or disposal.

These activities will continue until they are complete.

DOE issued a Request for Offers to sell certain uranium materials. The request included provisions that allow offerors to include use of any real property as part of the offer to purchase the DOE uranium. If DOE ultimately decides to accept an offer that includes the use of PGDP real property, such transfers will undergo a NEPA adequacy review to determine if additional NEPA analysis might be required beyond this EA.

1.3 Compliance with CERCLA

In May 1994, the U.S. Environmental Protection Agency (EPA) added the PGDP site to the National Priorities List. As a result of PGDP being placed on the National Priorities List, DOE and EPA entered into the Federal Facility Agreement (FFA) in April 1998. The FFA governs cleanup of designated areas and facilities at the PGDP and combines the CERCLA and *Resource Conservation and Recovery Act of 1976* (42 U.S.C. 6901 et seq.) authorities.

1.3.1 CERCLA SECTION 120(H)

DOE is responsible for remedial activity at the PGDP, and any transfer of PGDP real property would be required to comply with all applicable statutory and regulatory requirements. Section 120(h) of CERCLA is applicable to certain transfers because it imposes requirements on all transfers of federal real property to nonfederal entities to ensure continued protection of human health and the environment after the transfer. Section 120(h) allows a federal agency to transfer real property after the completion of remedial activity or, under certain circumstances, while remediation is ongoing.

CERCLA Section 120(h) imposes several requirements on transfers of federal real property to nonfederal entities:

- Give notice of hazardous substance activity to the transferee,
- Include a deed covenant that "all remedial actions necessary to protect human health and the environment with respect to any such substance remaining on the real property has been taken before the date of such transfer,"
- Include a deed covenant that the United States will return and perform any additional response action that may be required in the future, and
- Retain a perpetual right of access necessary to accomplish such additional response actions.

These requirements do not apply to interagency federal real property transfers, or to leases, licenses, or easements granted for the use of federal lands.

If all remedial actions necessary to protect human health and the environment are complete before the date of the transfer, this would be considered a Timely Transfer under Section 120(h) and the deed would include a covenant that DOE had taken all remedial actions necessary to protect human health and the environment in relation to substances that might remain on the site before the date of the transfer. If DOE transferred the real property before completing all remedial actions, this would be considered an Early Transfer. An Early Transfer allows an agency to defer the above-referenced deed covenant and transfer the real property before remediation is complete as long as safeguards are in place to protect human health and the environment. Early Transfer authority requires a 30-day period for the public to review and comment on the suitability of a real property for Early Transfer.

1.3.2 10 CFR PART 770 TRANSFER OF REAL PROPERTY AT DEFENSE NUCLEAR FACILITIES FOR ECONOMIC DEVELOPMENT

The regulations at 10 CFR Part 770 establish how DOE will transfer, by sale or lease, real property at defense nuclear facilities for economic development. 10 CFR Part 770 does not affect or modify CERCLA Section 120(h). Individual proposals for transfers of real property are subject to NEPA review as implemented by 10 CFR Part 1021. Thus, the transfer of real property may, at some time in the future, require a DOE NEPA adequacy review to determine if additional NEPA analysis might be required beyond this EA.

1.3.3 FEDERAL FACILITY AGREEMENT AND LAND USE CONTROLS

DOE, EPA, and Kentucky entered in a tri-party Federal Facility Agreement (FFA) in April 1998. The FFA parties issued a Memorandum of Agreement (Froede 2000) for the implementation of a Land Use Control Assurance Plan, which became effective on March 30, 2000. The Assurance Plan (DOE 2000) identifies the strategy for ensuring the long-term effectiveness of the relied-upon land use controls in protecting human health and the environment at areas of the PGDP undergoing remediation. For each final remedial action, DOE prepares a specific Land Use Control Implementation Plan.

In the event that the DOE determines to enter into any contract for the sale or transfer of the PGDP site, DOE will comply with the applicable requirements of Section 120(h) of CERCLA, including all public notice requirements. In addition, while the FFA is in effect, DOE will include notice of CERCLA requirements in any document that transfers ownership or operation of the PGDP to all subsequent owners and/or operators of any portion of the PGDP, and will notify EPA and Kentucky of any sale or transfer. DOE will consider the need to ensure continued maintenance of any land use controls that are part of a response action associated with an operable unit subject to transfer. No real property transfer attendant to Section120(h)(3)(b) of CERCLA can relieve DOE of its obligation to perform remediation pursuant to the FFA, and no transfer can relieve DOE of its obligations under 40 CFR Part 270, "Hazardous Waste Permit Program," or Title 401, Chapter 38, of the *Kentucky Administrative Regulations* (KAR), "Hazardous Waste Permitting Process." Further, real property transfers must comply with the appropriate conditions of the PGDP Hazardous Waste Management Permit and the FFA.

1.4 Advantages of Early NEPA Analysis

Federal agencies sometimes use conceptual projects in NEPA analyses to assess the environmental impacts of a proposed action that is broad in reach; subsequent decisions about actions can be further informed by subsequent NEPA analyses. NEPA analyses of conceptual projects are often necessary when there are limitations on available information or uncertainty about the timing, location, and impacts of implementing actions that are not precisely known. In the case of this EA, DOE has chosen to take a broad approach and to analyze a conceptual project to lay the foundation to support evaluation of future specific proposals for the reuse of the PGDP lands or facilities.

NEPA is a decisionmaking process. The earlier DOE can provide information to the public through a NEPA document, the sooner it can become a vehicle for public information and a vehicle for soliciting public input. The early approach has several benefits:

- It provides an opportunity for stakeholders to receive early information and provide input to DOE.

- It provides a baseline of environmental conditions against which DOE can compare specific proposals; if additional environmental assessment was required, the EA provides a roadmap for sources to new or updated information.

- It provides prospective users of the site with information on site constraints and DOE's ongoing regulatory responsibilities.

- It provides DOE the basis for preliminary decisions before considering the impacts of specific projects.

- It provides value in that it can address potential cumulative and indirect effects, which could allow the NEPA analysis for subsequent actions to tier to the initial analysis and thereby avoid duplicate analyses.

- It identifies the need for potential mitigation measures.

- If subsequent NEPA analysis is required, this EA will assist decisionmakers and the public in focusing on the most pertinent issues for decision.

- Provision of information to the public and solicitation of responses can allow DOE to address specific issues about the reuse of the site and can also result in more informed decisions about specific proposals.

1.5 Scope

DOE has prepared this EA to assess the consequences of the potential transfer of PGDP real property. Remediation of the PGDP site is independent of the Proposed Action described in this document and will be performed regardless of any transfer decisions.

The EA has been prepared in accordance with the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500 to 1508) that implement NEPA and the DOE NEPA implementing procedures in 10 CFR Part 1021. If DOE determines the impacts this EA describes are not significant, the Department will issue a Finding of No Significant Impact (FONSI) for the actions described in Sections 1.1 and 1.3. If impacts are potentially significant, DOE will consider a mitigated FONSI or evaluate the need to prepare an environmental impact statement. A mitigated FONSI would include specified mitigation measures that would reduce impacts below the level of significance. Future specific transfers may require a NEPA adequacy review to determine if additional NEPA analysis might be required beyond this EA.

If the Department determines there are significant impacts deriving from this EA or from any future supplement analysis of any specific future use, DOE would evaluate if a notice of intent and preparation of an environmental impact statement would be required. DOE would determine significance based on the context and intensity considerations provided in 40 CFR 1508.27.

Certain aspects of potential future uses (Section 2.1) could have a greater potential for creating adverse environmental impacts to some environmental resource areas than others. For this reason, the CEQ regulations (40 CFR 1502.1 and 1502.2) recommend a sliding-scale approach so that those actions with greater potential effect can be discussed in greater detail than those that have less potential for impact. DOE has already examined some of the actions this EA describes, including the continuation of DUF_6 conversion (DOE 2004).

This EA does not:

- Define to whom DOE could or might transfer land or facilities;
- Identify a recommended future use;
- Address CERCLA decontamination, decommissioning, and remediation activities (these activities will be addressed through the CERCLA process as discussed in Section 1.3); or
- Address work associated with the *Atomic Energy Act of 1954* (42 U.S.C. 2011 U.S.C. et seq.).

Because there currently is no specific proposed future real property transfer at this time, DOE developed a representative project (referred to in this EA as the "conceptual project"). Analysis of the conceptual project allows DOE to evaluate resource areas and potential consequences from the development, construction, and operation of potential industrial or commercial uses at the PGDP site. DOE defined the conceptual project as a generic facility that is 500,000 square feet in size (see Section 2.2.1 for more detail). DOE would have to complete several regulatory steps before it could transfer land or facilities. As discussed in Section 1.1, the EA is only one part of the process DOE must follow before it can transfer real property. If DOE ultimately accepted an offer that includes the use of PGDP real property, such transfers may require a NEPA adequacy review to determine if additional NEPA analysis might be required beyond this EA.

1.6 Public Participation

As part of DOE's public outreach effort for this EA, the Department invited the public and organizations who have expressed interest in the NEPA process, and the specific proposed actions at the PGDP, to participate in an information meeting and to provide input during the public comment period on the Draft EA.

Public Information Meeting and Public Comment Period

DOE announced the public information meeting through advertisements in local newspapers, including *The Paducah Sun*, the *West KY News*, and *Lone Oak News/The Good Neighbor*, and in a postcard DOE sent to about 1,500 local residents, elected officials, and other interested parties. DOE held the meeting on Tuesday, March 19, 2013, at the West Kentucky Community and Technical College in Paducah, and about 40 people attended. DOE employees were available for informal discussions during a 1-hour open house before the meeting. The meeting included a formal presentation and a question and answer session. Questions about covered topics included details of future transfers, future responsibility for cleanup of the site, and what areas of the PGDP DOE would include in the EA analysis. Appendix A includes a list of organizations and individuals that participated in the meeting.

DOE will accept comments on this Draft EA by mail, facsimile, or e-mail for a period of 45 days after publication. Comments should be addressed to Mr. Robert Smith using the contact information in the Cover Sheet. DOE will consider all comments, to the extent practicable, received by, or that are postmarked by, the close of the comment period in the preparation of the Final EA. During the 45-day comment period, the Department will hold a public comment meeting. The public comment meeting will be announced via the same process as the initial public information meeting described above. Written and verbal comments may be submitted at the public meeting in lieu of mailing them to DOE.

Coordination

On June 12, 2013, DOE sent a letter to request input on the Proposed Action from the Kentucky Field Office of the U.S. Fish and Wildlife Service (Service) and to confirm the list of threatened and

endangered species that might be present in McCracken County (see Section 3.8). The Service responded on June 20, 2013. In addition, the Department sent letters to 10 American Indian tribes to request their respective input on the Proposed Action and any cultural resources important to them that might be present.

Appendix B contains copies of all correspondence sent and received by DOE in that regard. The Cherokee Nation responded to DOE's letter. The tribe indicated it has no records of cultural resources in the area, requested that DOE contact the Eastern Band of Cherokee Indians, and requested further consultation if items of cultural significance are discovered. DOE included the Eastern Band of Cherokee Indians in its request for information. If items of cultural significance are discovered while DOE remains responsible for any action at the PGDP site, DOE would further consult with the affected tribes. DOE did not receive responses from the other tribes.

DOE held a conference call with the Kentucky State Historic Preservation Officer (SHPO) on May 9, 2013 (Groppe 2013). DOE explained the purpose and need for the EA as discussed above and the general approach of the EA. The Department informed the SHPO that it will follow Section 4 of the *Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky* (BJC 2006), which details DOE's Cultural Resource Management Methods for PGDP, and that the Department will consult with the SHPO as appropriate under that plan.

CHAPTER 2. DESCRIPTION OF THE PROPOSED ACTION AND NO-ACTION ALTERNATIVE

2.1 Proposed Action

The Proposed Action this EA addresses is the potential transfer of DOE real property at the PGDP site to one or more entities.

If DOE transferred real property to a nonfederal entity, subsequent actions by the new owner could be private and beyond the scope of federal decisionmaking. However, DOE would be required to continue to perform certain actions and maintain certain responsibilities as discussed in Sections 1.3,1, 1.3.2, and 1.3.3. Remediation of the PGDP site is independent of the Proposed Action described in this document and will be performed regardless of any transfer decisions.

DOE has excluded some areas of the site from consideration for transfer at this time. The Proposed Action in this EA does not include transfer of the following:

- Waste burial grounds or permitted landfills (S, T, and U),
- Lands and supporting facilities for the Depleted Uranium Hexafluoride (DUF_6) Facility, and
- Any areas that contain waste that is governed by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA; 42 U.S.C. 9601 et seq.), including any area that may be designated in a future CERCLA decision for an onsite waste disposal cell.

2.2 Basis for Impact Analysis

For analytical purposes, this EA examines reasonably foreseeable potential industrial and recreational uses that could occur after DOE transferred land or facilities as discussed in Section 2.1.

The transfer action itself would not have environmental impacts; rather, future development and use by a new owner(s) could have the potential for environmental impacts. This EA focuses on a range of potential impacts that could result from two potential types of activities after transfer: (1) industrial use (which could include commercial use) and (2) recreation and wildlife management use. DOE's analyses in this EA provide estimations of the bounding impacts that could occur with reuse of the site.

The Kentucky Research Consortium for Energy and the Environment at the University of Kentucky was charged by DOE with soliciting and integrating public, regulatory, and technical community input to produce a publicly approved End State Vision Report for the PGDP and surrounding impacted areas. Public meetings were conducted in January 2011 (DOE 2011). After receiving public input, the consortium developed a community-based future vision for the PGDP that identified a range of community perspectives and preferences for the site's future after DOE closes the facility. The scenarios developed and discussed as part of the End State Vision document focused on heavy industrial, light industrial, and recreational activities at the PGDP site. The analysis presented in this EA uses the industrial and recreational scenarios as a foundation for estimating potential future impacts.

To address the uncertainty in potential future uses, DOE assumed the following guidelines for evaluation of potential future uses:

- County zoning ordinances and development guidelines would be followed.

- Construction activities involving ground disturbance would be managed to limit the potential for soil erosion and sedimentation.

- Sensitive resources, including cultural and historic resources, would be identified in the deed for transferring real property with specific provisions to enable protection as necessary through the use of deed restrictions and compliance with all applicable federal, Kentucky, and local requirements.

- Future owners or occupants would be responsible for seeking and obtaining all applicable federal, Kentucky, and local permits for air emissions, water discharges, waste disposal, storage and treatment of hazardous wastes, and any other required permits.

- Future nonfederal occupants that would handle or use radioactive materials, or conduct other radiological operations, would be subject to NRC or Kentucky regulations and would need to obtain all applicable permits and licenses.

- Certain uses, especially those that would require additional permits or licenses for construction or operations (a power plant, for example), could require an environmental impact statement by the responsible parties.

- Conveyances would follow the CERCLA Section 120(h) environmental due diligence process where required.

- Depending on the results of CERCLA Section 120(h) reviews and analyses of risk from the specific properties requested for transfer, other land use controls and provisions could be attached to the deed for transferred real property either for a specified period of time or indefinitely.

- Transfers would comply with any applicable Federal Facility Agreement (FFA) and Land Use Control Assurance Plan (DOE 2000) requirements.

- DOE and other parties would comply with the *Endangered Species Act of 1973* (16 U.S.C. 1531 et seq.) and the *National Historic Preservation Act* (16 U.S.C. 470 et seq.), as applicable, including any required further analysis. The *Endangered Species Act of 1973* would apply to federal and nonfederal owners or users. The relevant portions of the *National Historic Preservation Act* would apply only to federal agencies.

2.2.1 INDUSTRIAL USE (CONCEPTUAL PROJECT)

DOE could transfer real property for industrial uses (which could include commercial uses). These uses would be compatible with the existing zoning (heavy industry). Potential uses could include but would not be limited to the following:

- Heavy manufacturing such as paper or pulp mills;

- Truck and rail service terminals;

- Public utility facilities with storage yards;

- Research and development with or without storage or operations;

- Waste treatment, storage, or recycling centers;

- Radiological industries such as research, uranium enrichment, fuel fabrication, and nuclear material collection and recycling;
- Bulk oil, gasoline, or natural gas storage;
- Power plants such as new generation nuclear demonstration plants and biomass facilities;
- Wholesale establishments;
- Warehousing;
- Equipment sales and repair facilities;
- Office parks; and
- Distribution centers.

Because DOE currently does not know the actual future uses of PGDP land and facilities, DOE selected a representative project (referred to in this EA as the "conceptual project") that would allow DOE to evaluate resource impacts and the potential consequences of a potential industrial reuse of the site. DOE defined the conceptual project as a facility of 500,000 square feet. DOE will use this analysis as a basis for estimating the potential environmental impacts of reasonably foreseeable actions that could occur after real property transfer. Potential uses would be contingent on a transferee's receipt of permits, receipt of authorizations, and completion of additional reviews under NEPA, if necessary. The potential environmental impacts for each environmental resource area (discussed in Chapter 3) are focused on size, land disturbance, and generic industrial operations to characterize potential impacts.

Sections 2.2.1.1 and 2.2.1.2 describe the parameters for construction and operation, respectively, for the conceptual project. While the conceptual project attempts to capture many of the potential impacts that would be encountered from potential future land use scenarios, DOE will undertake a NEPA adequacy review to determine additional NEPA analysis might be required beyond this EA.

2.2.1.1 Construction of the Conceptual Project

The analysis in this EA characterizes the potential impacts of reasonably foreseeable industrial uses because industrial uses historically have the potential for greater impacts than commercial uses. Specific resource areas that could be impacted at a greater level are traffic, air emissions, water use, and land disturbance. To determine the level of impacts, NEPA requires all impacts be evaluated for determination of significance based on the consideration of context and intensity as described in 40 CFR 1508.27.

The conceptual project DOE used to assess the impacts from reasonably foreseeable industrial uses consists of a 500,000-square-foot facility with associated parking lots, utility connections, and access roads. Table 2-1 lists the assumed construction parameters.

2.2.1.2 Operations of the Conceptual Project

DOE assumed for the analysis that future industrial operations at the PGDP site, whether in the undeveloped or developed areas of the site, would likely result in the same or less use of water, materials, energy, and transportation than current or historical levels at the PGDP. DOE also assumed operations would consist of activities appropriate to an industrial facility, a large warehousing complex, or other

Table 2-1. Conceptual construction parameters for a 500,000-square-foot facility (DOE 2013b).

Parameter	Value[a]
Land use for facility, roads, parking lot, and construction laydown yards	25 acres
Electricity	6,000 megawatt-hours[b]
Water	3,000,000 gallons[c]
Natural gas	Minimal
Steel and concrete	1,250 tons of steel 75,000 tons of concrete
Large-scale equipment	2 cranes, 2 bulldozers, 2 short haul-trucks, 2 front-end loaders, 1 backhoe
Annual workforce	120
Truck transports in and out of the site	4,160[d]
Wastes generated	No hazardous waste 4,000 tons of waste (steel, concrete, and other debris)[e]

a. Over the entire construction period of 12 months.
b. Electricity use based on electrical requirements for two office trailers (lighting, air conditioning, and heating) and electricity use (interior lighting, heating, air conditioning, and equipment use) during construction.
c. Water use based on requirements for general construction worker support, minimal building (masonry), and dust suppression.
d. Number of daily truck transports based on an 18-ton truck capacity and 260 working days per year (5 days a week for 52 weeks).
e. Waste generated is assumed to be 5 percent of the total amount of steel and concrete used during construction and site preparation.

large facility. Future owners or occupants would be responsible for seeking and obtaining, or revising, all necessary and applicable federal, Kentucky, and local permits and licenses for facility operations. Examples would include building permits, air emission permits, and industrial wastewater discharge permits.

2.2.2 RECREATION AND WILDLIFE MANAGEMENT USES

DOE could transfer some or all of the real properties for recreation and wildlife management uses. Recreation uses would result in the least potential for environmental impacts and could include but not be limited to:

- Wildlife viewing and management areas,
- Hunting,
- Bird dog trials,
- Dog training,
- Playgrounds,
- Sports fields,
- Hiking trails, and
- Nature interpretive programs.

DOE expects the impacts of construction and operation for recreational activities would be less than those of industrial use.

2.2.3 USES CONSIDERED BUT ELIMINATED

DOE did not include residential use in the analysis because it is not a reasonably foreseeable future use for any real property at the PGDP.

2.3 No-Action Alternative

The No-Action Alternative provides an environmental baseline for comparison with the impacts of the Proposed Action and is required under NEPA regulations. The description of the potential No-Action Alternative consequences is provided in Section 3.1, and applies to each environmental resource area in Chapter 3 (Sections 3.2 thorough 3.13). The environmental management activities described in Section 1.2 will continue until they are complete. Under the No-Action Alternative, DOE would not transfer any of the lands or facilities at the PGDP. DOE would maintain a level of security and maintenance appropriate to site activity that would include:

- Providing physical safety and security of DOE facilities,
- Ensuring the integrity of facilities through preventive maintenance activities, and
- Maintaining fencing and an appropriate security force to ensure property protection.

Under the No-Action Alternative, DOE assumes 1,986 acres would continue to be licensed to Kentucky as part of the WKWMA; DOE assumed for the analysis that current activities in that area would continue. Public activities in the wildlife management area could continue to include bow hunting for deer, bird dog and retriever trials, youth turkey hunting, horseback riding, hiking, biking, and firearms hunting for small game (LATA 2012a, 2012b).

Continued remediation of the PGDP site is independent of the Proposed Action described in this document.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment and environmental impacts of the Proposed Action to the natural and human environment for the following potentially affected environmental resource areas: land use, air quality, aesthetics, noise, geology and soils, water resources, biological resources, socioeconomics and environmental justice, cultural resources, infrastructure and transportation, waste management, human health and safety, and intentionally destructive acts. Section 3.1 addresses the potential impacts associated with the No-Action Alternative. The Proposed Action in this EA analyzes the potential transfer of DOE real property at the PGDP site to one or more entities for uses that could be different from its current use. The transfer action itself would not have environmental impacts; rather, future development by a new owner could have the potential for environmental impacts. To provide information and context to decisionmakers and other document reviewers, this EA analyzes reasonably foreseeable industrial and recreation and wildlife management uses. To evaluate the impacts of future industrial use, DOE analyzed a conceptual project (see Section 2.2.1) that would involve construction and operation of a 500,000-square-foot facility.

The analysis in this EA serves only as a basis for estimating the potential environmental impacts of development, construction, and operational actions after property transfer and assists DOE in identification of information for planning, potential data needs, and land use restrictions. Potential uses would be contingent on receipt of necessary permits, authorizations, and additional environmental reviews by the transferees. Future specific transfers will require a NEPA adequacy review to determine if there is a need for additional NEPA analysis in connection with those transfers.

3.1 No-Action Alternative

NEPA requires consideration of a No-Action Alternative. This section presents the potential environmental impacts of the No-Action Alternative as described in Section 2.3.

Under the No-Action Alternative, DOE would not transfer any of the real property at the PGDP site. The Department would maintain a level of security and maintenance appropriate to site activities. As use of buildings declined over time, DOE either would maintain them to prevent deterioration and accident hazards or would demolish them. The environmental management activities described in Section 1.2 would continue until completion.

The following bulleted list presents the potential consequences of the No-Action Alternative. The bulleted resource areas are the same as the resources areas covered in Sections 3.2 through 3.13 for the affected environment and the potential impacts of the Proposed Action discussions.

- Land Use. DOE does not anticipate changes to onsite land uses or the disturbance of large tracts of land. The continued maintenance or repair of infrastructure and onsite structures would be expected.

- Air Quality. With the cessation of uranium enrichment operations, air emissions including fugitive dusts and vehicle emissions would be reduced from historical levels. No new air emission sources would be expected under the No-Action Alternative.

- Aesthetics. No activities would be expected that would alter the existing site character or views from around the PGDP site on the WKWMA.

- Noise. With the end of uranium enrichment operations, current PGDP noise levels have been reduced from those during full operations.

- Geology and Soils. DOE would continue institutional controls to keep contamination from migrating to other areas and away from any pathways that could lead to human exposure or releases to the environment.

- Water Resources. Because the real property would remain in its current condition, the amount of runoff from the site would not change but discharges of treated wastewater to Bayou and Little Bayou Creeks would likely decrease with the end of site operations. In addition, there would be less water withdrawn from the Ohio River to support site activities.

- Biological Resources. With the cessation of operations and the reduction of the number of employees on the site, with consequent reduction in vehicular activities, various species of small mammals, reptiles, and birds could again become more prevalent at the site. Depending on the magnitude and frequency of grounds maintenance activities, some native plant species could begin to reemerge in various portions of the site.

- Socioeconomics and Environmental Justice. Because uranium enrichment operations have ceased, site employment is reduced. Without transfer of real property for new uses, site employment would be as described in Section 3.9.1.1. Because there would be no high and adverse impacts to any segment of the population under the No-Action Alternative, there would be no environmental justice impacts.

- Cultural Resources. If routine ground and site maintenance activities uncovered artifacts or other signs of potentially significant cultural resources, DOE would follow its agreements with the Kentucky SHPO and, if appropriate, consult with affected American Indian tribes.

- Infrastructure and Transportation. The routine maintenance of piping, roadways, and other elements of the site's infrastructure would be consistent with ongoing activities. Therefore, there would be no negative impacts to infrastructure and transportation.

- Waste Management. Because of ceased operations and reduction of site personnel, there would be no impacts to waste disposal capacities; waste volumes would likely decrease from volumes that were generated during full operations.

- Human Health and Safety. With ceased operations and the reduced workforce, radiological risk would be as described for the DUF_6 Facility in Section 3.13.1.2 and would further decline over time.

- Intentionally Destructive Acts. Potential impacts are expected to be extremely low as described in Section 3.14.

3.2 Land Use

3.2.1 AFFECTED ENVIRONMENT

The PGDP site is in a generally rural area of McCracken County, Kentucky, about 10 miles west of the City of Paducah and 3.5 miles south of the Ohio River (see Figure 1-1). Figure 3-1 shows the layout of the site; Figure 3-2 is an aerial photograph. DOE land holdings at the PGDP site encompass 3,556 acres

(the blue line in Figure 3-1). The DOE land has a more heavily developed industrial area with undeveloped lands around it that Kentucky uses for wildlife management purposes. The industrial area of the site occupies 1,570 acres consisting of 748 acres inside the security fence (red line) and another 822 acres containing the DUF_6 Facility, roads, parking lots, grassy areas, utility infrastructure, water impoundments, and the K, S, T, and U landfills. The undeveloped land associated with the WKWMA occupies 1,986 acres and contains access roads and multiple rights-of-way for electrical

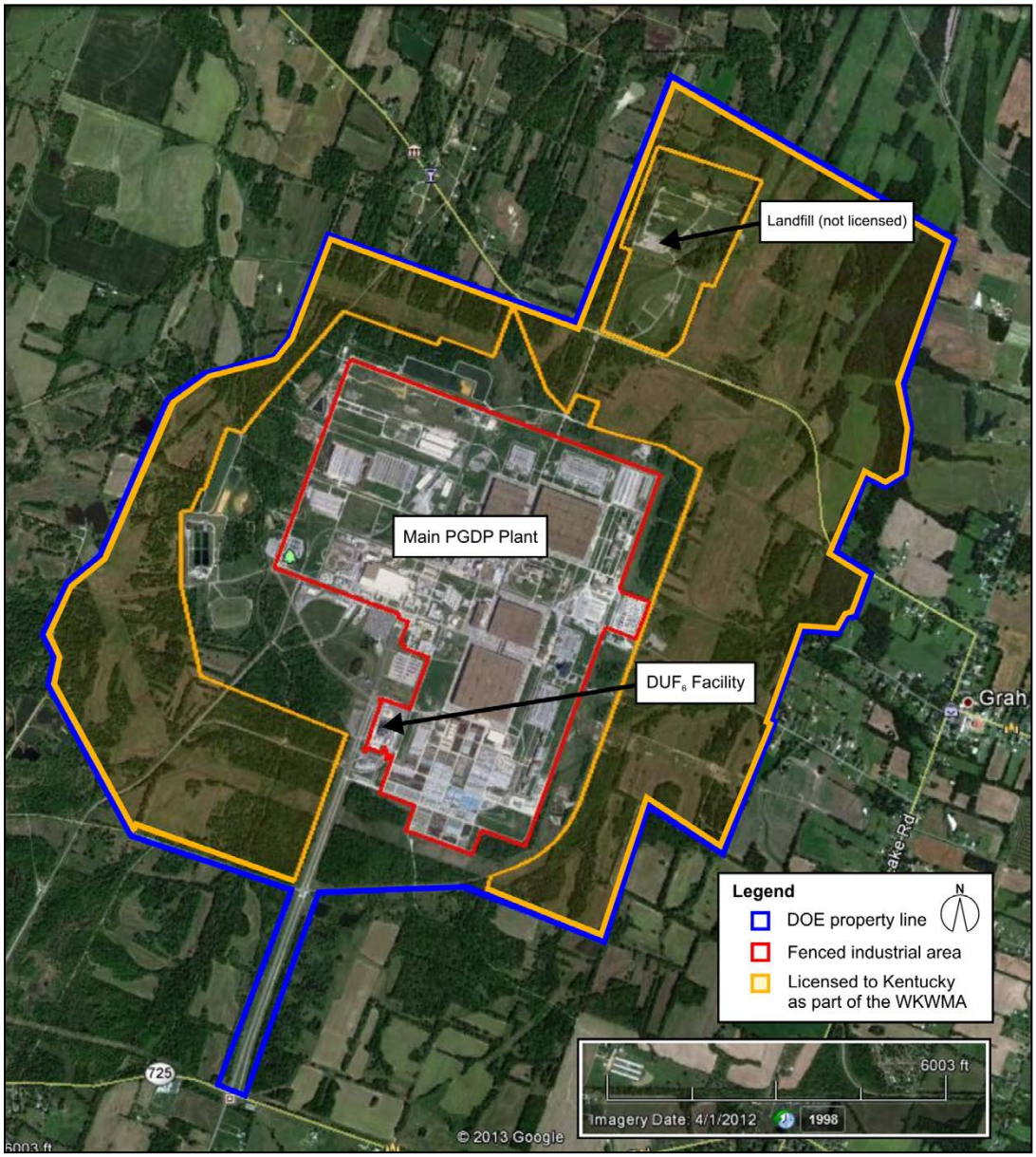


Figure 3-1. Land use at the PGDP site.

transmission lines but is otherwise a mixture of grass meadows, forested areas, and areas of diverse vegetation (see Section 3.8). DOE currently licenses this area to Kentucky as part of the WKWMA (yellow line and shading Figure 3-1), with the exception of a landfill in the northeastern part of the site.

The primary land use in the industrial area of the site has been the production of enriched uranium fuel. In addition, DOE conducts environmental remediation, waste management, DUF_6 management, and

Figure 3-2. Aerial photograph of the PGDP site and immediate vicinity.

decontamination and decommissioning activities as a part of its environmental management mission. The fenced area of the site is heavily developed and includes five major process buildings with many support facilities. The areas between buildings consist primarily of mowed grassy areas.

The developed lands outside the security fence consist of 822 acres containing roads, parking lots, grassy areas, utility infrastructure, water impoundments, landfills, and burial grounds.

Figure 3-3 shows features of the WKWMA. Public activities in the wildlife management area include bow hunting for deer, bird dog and retriever trials, youth turkey hunting, horseback riding, hiking, biking, and firearms hunting for small game (LATA 2012a, 2012b). The entire PGDP site is currently zoned for heavy industry; therefore, industrial use would be compatible with existing McCracken County zoning.

3.2.2 ENVIRONMENTAL CONSEQUENCES

3.2.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Section 2.2.1 and Table 2-1). The entire PGDP site is currently zoned for heavy industry; therefore, industrial use would be compatible with existing McCracken County zoning.

Land use impacts could be minimal if new users sited industrial facilities in the developed area. Not all of the land available for transfer is equally developable because of various considerations that would require planning and coordination by the transferee, such as federal protection of wetlands. Further, certain restrictions or land use controls could need to be developed in coordination with the DOE environmental management program to ensure that uses are consistent with the cleanup objectives and their resultant exposure scenarios, applicable McCracken County zoning requirements, and the ability to obtain construction and operating permits and licenses.

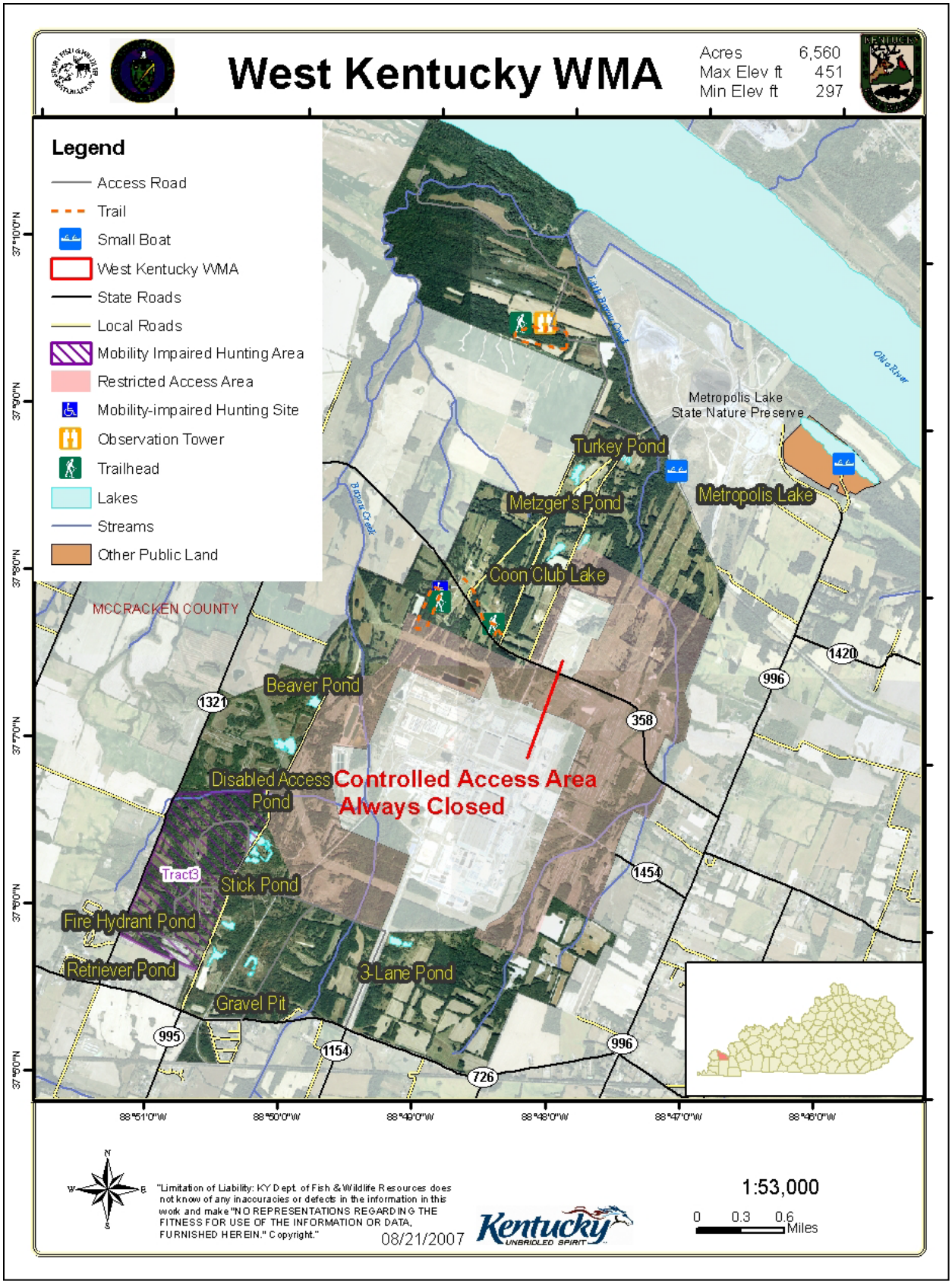


Figure 3-3. West Kentucky Wildlife Management Area (Ethridge 2013).

Future users could seek to locate the 25-acre conceptual project within the undeveloped 1,986 acres Kentucky leases from DOE and manages as part of the WKWMA. This would include the footprint of the new facility and associated parking, utility connections, additional roads, and construction laydown areas. Such a change in land use could result in construction of facilities closer to nearby residences. Construction impacts to wetlands and biological resources are discussed in Sections 3.7 and 3.8, respectively.

Construction in the undeveloped areas would have the potential to affect public activities, including bow hunting for deer, bird dog and retriever trials, youth turkey hunting, horseback riding, hiking, biking, dog training and trials, and firearms hunting for small game. The extent of the impact would be dependent on the size and location of the construction activities.

Overall impacts would depend on the type of industrial development, which would be subject to the applicable regulatory processes (for example, licensing and permitting) and any specific requirements of McCracken County zoning. Land use impacts could be minimized if the transferee's development plans incorporated attributes such as buffers and landscaping, modern building architecture, and efficient utilities technologies.

Land use in a transmission line right-of-way includes certain conditions that are in effect and would not change as a result of the Proposed Action. The existing rights-of-way would be kept clear of all structures, fire hazards, many vegetation types, and any other use that could interfere with the safe operation or maintenance of the line. There would be no building construction in a right-of-way. Therefore, potential reuses of the lands under or near the right-of-way would be limited.

Operations. The entire PGDP site is currently zoned for heavy industry; therefore, the conceptual project would be compatible with existing McCracken County zoning. Future operations in the undeveloped areas would have the potential to affect public activities, including bow hunting for deer, bird dog and retriever trials, youth turkey hunting, horseback riding, hiking, biking, dog training and trials, and firearms hunting for small game. The extent of the impact would be dependent on the size and location of the industrial operations.

3.2.2.2 Recreation and Wildlife Management Uses

DOE expects potential land use impacts from recreation and wildlife management uses would be minimal because most of the area would be open space for recreational and wildlife purposes. Conversion of the developed areas for these uses could involve demolition and removal of industrial and support facilities, including paving and utility structures, and that land use could change from industrial to recreation and wildlife management. There could be a limited amount of construction or use of existing buildings to support this use, but the impacts would be minimal and could be minimized if development plans incorporated appropriate buffers and landscaping, modern building architecture, and efficient utilities technologies. Recreation and wildlife management uses in the developed or undeveloped areas would have negligible impacts and would be consistent with current land use practices at the WKWMA.

3.3 Air Quality

3.3.1 AFFECTED ENVIRONMENT

DOE characterizes ambient air quality in an area in terms of the primary and secondary National Ambient Air Quality Standards (NAAQS; Table 3-1). The *Clean Air Act* (42 U.S.C. 7401 et seq.) requires the EPA to set standards for pollutants considered harmful to public health and the environment. National primary ambient air quality standards define levels of air quality EPA has determined as necessary to

provide an adequate margin of safety to protect public health, including the health of sensitive populations such as children and the elderly. National secondary ambient air quality standards define levels necessary to protect the public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. EPA has established primary standards for six criteria pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter [which includes particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) and less than or equal to 2.5 micrometers ($PM_{2.5}$)], and sulfur dioxide. The basis for implementing the NAAQS in Kentucky is in *Kentucky Administrative Regulations* (KAR) Chapter 51, "Attainment and Maintenance of the National Ambient Air Quality Standards."

Table 3-1. National Ambient Air Quality Standards (40 CFR Part 50, as of October 2011).

Pollutant	Primary	Secondary	Form
Nitrogen dioxide			
Annual arithmetic mean	0.053 ppm	Same as primary	Annual mean
1-hour	0.10 ppm	None	98th percentile, averaged over 3 years
Ozone			
8-hour average (2008 standard)	0.075 ppm	Same as primary	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate matter			
24-hour average	150 $\mu g/m^3$	Same as primary	Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$			
Annual arithmetic mean	12.0 $\mu g/m^3$	Same as primary	Annual mean, averaged over 3 years
24-hour average	35 $\mu g/m^3$	Same as primary	98th percentile, averaged over 3 years
Sulfur dioxide			
3-hour average	None	0.5 ppm	Not to be exceeded more than once per year
1-hour average	0.075 ppm	None	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.

Based on measured ambient air pollutant concentrations, the EPA designates if areas of the United States meet NAAQS. Those areas demonstrating compliance with the standards are considered "attainment" areas, while those that are not in compliance with the standards are known as "nonattainment" areas. Those areas that cannot be classified on the basis of available information for a particular pollutant are "unclassifiable" and are treated as attainment areas until proven otherwise. McCracken County is in attainment for all criteria pollutants.

Air quality can be evaluated by comparing concentrations in the county to the NAAQS for six common air pollutants—ground-level ozone, particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and lead. The most widespread health threats are from particle pollution and ground-level ozone.

Any stationary source emitting more than 10 tons per year of any hazardous air pollutant, or 25 tons per year of any combination of hazardous air pollutants is considered a major source and is subject to regulation. At the PGDP, only the DUF_6 Facility is a conditional major source of air pollutants. The air permit for PGDP limits pollutant emissions to less than the major source category (LATA 2014).

Authority for enforcing compliance with the *Clean Air Act* and subsequent amendments resides with EPA Region 4 and the Kentucky Division for Air Quality. The Paducah site complies with federal and Kentucky rules by implementing the *Clean Air Act* and its amendments.

3.3.2 ENVIRONMENTAL CONSEQUENCES

3.3.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Section 2.2.1 and Table 2-1). Heavy equipment for site preparation and construction would generate air pollutants from their fuel, as would delivery vehicles and commuting construction workers in their personal vehicles. In general, these emissions would be short-term, sporadic, and localized (except for emissions associated with the personal vehicles of construction workers and vehicles transporting construction materials and equipment). Dispersion would decrease concentrations of pollutants in the ambient air as distance from the construction site increased. The quantities of air pollutants from vehicles and equipment for construction would not be a substantial contribution to the total emissions from mobile sources already operating in the area and would not adversely affect local air quality.

Construction activities could generate an increase in fugitive dust (that is, particulate matter that escapes from a construction site from earthmoving and other construction vehicle operation. The amount and duration of fugitive dust emissions would be dependent on the number and size of facilities and duration of construction. Not all of the available area would be under construction at any one time. Increases in fugitive dust concentrations would probably be noticeable on the site and in the immediate vicinity, and ambient concentrations of particulate matter could rise in the short-term. However, control measures for lowering fugitive dust emissions, such as covers and water or chemical dust suppressants that could be applied by the transferee, would minimize these emissions.

The potential impacts to air quality from construction would be the same for construction on developed and undeveloped lands. The amount of necessary construction equipment and disturbance would be comparable for undeveloped and developed lands. Dust suppression activities by the transferee would limit fugitive dust from either developed or undeveloped land.

Operations. Specific details about atmospheric pollutants that could result from the conceptual project (or industrial facilities in general) are unknown at this time. However, the types of industries and businesses that DOE can reasonably anticipate could produce air emissions typical of standard industrial and research operations. Table 3-2 shows the relative air emissions from permitted facilities in McCracken County using the latest available (2008) EPA emission inventory information (EPA 2013). New industry that located in the area of land transfer (as represented by the conceptual project) would be likely to have similar types of air emissions and be minor contributors as those presented in Table 3-2. The overall impact on air quality from industrial facilities would be minimal because new major emitters would require Kentucky air permits that would limit and control emissions and potential impacts to air quality.

Facilities typically control minor emissions using conventional treatment technologies like scrubber systems and particulate filters, and external effects are negligible. New facility operations that have minor air contaminant sources may or may not be required to receive an air permit based on the source's potential to emit. The Kentucky Division of Air Quality maintains permitting and registration guidelines on its website (http://air.ky.gov/Pages/AirPermits.aspx). Major sources of air emissions typical of many heavy industries could be subject to a Title V operating permit from the Division under 401 KAR 52:020, "Title V Permits." A Title V permit is required for any facility operations with the potential to emit more than 100 tons per year of any regulated air pollutant, 10 tons per year of any hazardous air pollutant, and/or 25 tons per year of any combination of hazardous air pollutants. If required, an operator would need to obtain the appropriate permits, which would mitigate the potential for adverse air quality impacts.

Table 3-2. McCracken County air emissions (percent) from stationary sources, 2008 (EPA 2013).

Industry Description	$PM_{2.5}$	PM_{10}	Nitrous oxides	Sulfur dioxide	Carbon monoxide	Volatile organic compounds	Ammonia	Lead	Mercury	All
Fossil Fuel Electric Power Generation (TVA Shawnee Fossil Plant)	85.8%	89.3%	98.0%	98.2%	96.0%	40.9%	100.0%	50.3%	95.0%	**83.7%**
Airport Operations	0.1%	0.5%	0.0%	0.0%	3.4%	1.1%	0.0%	48.1%	0.0%	**5.9%**
Plastics Product Manufacturing	4.7%	3.4%	0.0%	0.0%	0.0%	19.2%	0.0%	0.0%	0.1%	**3.1%**
Inorganic Chemical Manufacturing (USEC)	0.9%	0.9%	1.9%	1.8%	0.2%	0.2%	0.0%	1.5%	4.9%	**1.4%**
Commercial and Industrial Machinery and Equipment Repair, Maintenance	0.7%	0.5%	0.1%	0.0%	0.1%	10.2%	0.0%	0.0%	0.0%	**1.3%**
Metal Coating, Engraving and Allied Services to Manufacturers	1.5%	0.9%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	0.0%	**1.0%**
Miscellaneous Fabricated Metal Product Manufacturing	1.5%	1.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	**0.8%**
Adhesive Manufacturing	2.0%	1.3%	0.0%	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%	**0.7%**
Audio and Video Equipment Manufacturing	0.1%	0.0%	0.0%	0.0%	0.0%	3.2%	0.0%	0.0%	0.0%	**0.4%**
Warehousing and Storage (bulk terminal)	0.0%	0.0%	0.0%	0.0%	0.1%	3.2%	0.0%	0.0%	0.0%	**0.4%**
Conveyor and Conveying Equipment Manufacturing	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	**0.4%**
Brick, Stone, and Related Construction Material Merchant Wholesalers	1.5%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.3%**
Petroleum Bulk Stations and Terminals	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	**0.3%**
Ready-Mix Concrete Manufacturing	0.6%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.1%**
Automotive Body Shops & Painting	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	**0.1%**
Mineral Wool Manufacturing	0.2%	0.1%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	**0.1%**
Asphalt Hot Mixture Plant	0.2%	0.2%	0.0%	0.0%	0.1%	0.4%	0.0%	0.0%	0.0%	**0.1%**
Administration of Air, Water, & Solid Waste Management Programs (DOE)	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	**0.04%**
General Medical and Surgical Hospitals	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Grain and Field Bean Merchant Wholesalers	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Crushed and Broken Limestone Mining and Quarrying	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Electroplating, Plating, Polishing, Anodizing, and Coloring	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total emissions in 2008 (tons)	**285**	**538**	**20,400**	**37,300**	**3,820**	**392**	**66**	**0.226**	**0.00215**	**Not applicable**

Note: PM_{10} and $PM_{2.5}$ indicate particulate matter with aerodynamic diameters less than or equal to 10 micrometers and less than or equal to 2.5 micrometers, respectively.

3.3.2.2 Recreation and Wildlife Management Uses

Recreational activities, including wildlife management, would have negligible air quality impacts in the developed and undeveloped areas. Some uses could involve emissions from construction vehicles or small recreational motor vehicles. However, these emissions would be negligible in terms of the regional air quality.

3.4 Aesthetics

3.4.1 AFFECTED ENVIRONMENT

NEPA and CEQ regulations stipulate that aesthetics (sometimes referred to as visual resources) is one of the elements or factors in the human environment that must be considered in determining the effects of a proposed action. For example, would the proposed action impede the view of or change the visual characteristics of identified visual resources such as important landmarks and historic sites, parks, and designated scenic areas or roadways. There are no designated scenic areas in the near vicinity of the PGDP.

The PGDP site is in a generally rural area of McCracken County, Kentucky. The area is characterized by gently rolling terrain in the upland areas to relatively flat flood plain near the Ohio River. The dominant viewshed (an area visible to the human eye from a fixed vantage point) consists of buildings, a water tower, cylinder storage yards, transmission lines, and open and forested buffer areas. Open areas within the facility are maintained grassy areas and fields. There are open and forested buffer areas, agricultural areas, residential areas, and forested areas adjacent to the PGDP site. Figure 3-1 shows the mixed nature of the landscape.

3.4.2 ENVIRONMENTAL CONSEQUENCES

3.4.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of the industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1).

Potential construction impacts in the developed or undeveloped area on aesthetic resources would be short term, occurring only during the construction period. The conceptual project would involve the presence of construction workers and construction equipment on the site. Large equipment such as a crane with a vertical profile could be visible from various locations and distances from the site.

Operations. The conceptual project would result in additional building and support structures on the site. Their visibility from various locations and distances around the site would depend on the footprints heights, exact location, and designs of the facilities. Placement of the conceptual project closer to the boundary of DOE's property in the undeveloped portion of the site could cause greater impacts. However, because it is assumed to be an industrial facility, a change in the current visual characterization of the PGDP site would be minimal.

Dependent on the operational requirements and processes for the facilities, plumes from stacks and/or cooling towers could be seen from various locations and distances around the site. If the facility required cooling towers, that would introduce an additional structure that could be seen. Nevertheless, the overall character of the area would not be different from the existing facilities.

3.4.2.2 Recreation and Wildlife Management Uses

The visual impacts to areas around the site would depend on the footprints, heights, exact location, and designs of any new recreational or wildlife management facilities. If any areas of the PGDP site were devoted to recreation or wildlife management uses, the potential impacts would be a transition to more passive uses and a blending with the current open spaces around the site. There would be no adverse visual impacts because of the industrial nature of the surrounding site, even if construction and operations occurred in the previously undeveloped portions of the site. Any construction-related impacts would be short in duration.

3.5 Noise

3.5.1 AFFECTED ENVIRONMENT

Noise can be sound of any type, but is often characterized as *unwanted* sound because it is loud, dissonant, unpleasant, unexpected, or unintelligible. There are several sound characteristics that affect how humans react to noise, but the most important is typically loudness. Sound waves are measured by the pressure they create, and the way humans perceive the loudness of sound is expressed as the sound pressure level. Sound pressure level, or sound level, is expressed in units of decibels above a standard reference level of 0 decibel, which corresponds to the threshold of human hearing at 1 kilohertz (1,000 cycles per second). Sound level is often expressed using the A-weighted decibel (dBA) scale; this scale is weighted toward those portions of the frequency spectrum between 20 and 20,000 hertz to which the human ear is most sensitive. Figure 3-4 shows typical sound levels using the dBA scale.

Humans can hear sounds that are more than 1 million times louder than the sound pressure at the hearing threshold. However, commonly encountered sound levels are in the range of 40 to 100 decibels. This is because sound level is expressed as sound pressure measurements on a logarithmic scale. Such a scale is helpful in reducing a large range of values to a more manageable range. The decibel is not a measured unit, but rather is the logarithm of the ratio of the measured sound pressure to the reference sound pressure. This allows comparison of the sound levels of a normal conversation at 40 decibels and a jet engine (100 feet away) at 150 decibels when the sound pressure measurements vary by a factor of 300,000. This jet engine sound pressure is more than 30 million times the reference sound pressure (corresponding to 0 decibel) (Colby et al. 2009).

The noise-producing activities on the PGDP site are remediation and construction activities and local traffic; they are similar in sound level to those at other industrial sites. Most nonconstruction noise sources are enclosed in the buildings. Another noise source is rail traffic in and out of the PGDP site. In particular, train whistle noise at a typical noise level of 95 to 115 dBA is high at public grade crossings. At present, rail traffic noise is not a factor in the local noise environment because of infrequent traffic (about one train per week).

The PGDP site is in a rural setting, and no residences or other sensitive receptor locations (for example, schools or hospitals) are in the immediate vicinity of noise-generating operations on the site. Otherwise,

ambient noise levels in the potential land transfer area are relatively low. Measurements at the residence closest to the plant (about 3,000 feet from the PGDP fence line on McCaw Road) ranged from 44 to 47 dBA when the site was in full operation (DOE 2004). At nearby residences, noise emissions from the plant itself were reported as undetectable from background noise.

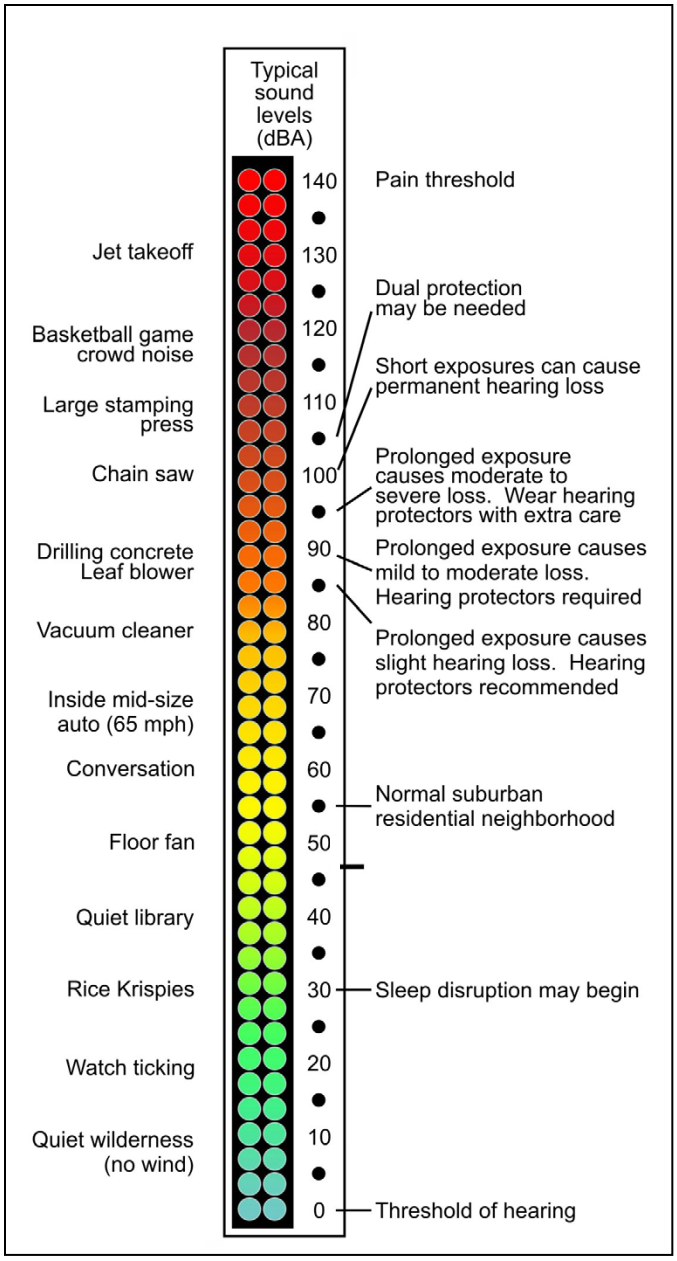


Figure 3-4. Typical sound levels on the A-weighted decibel scale (modified from 3M 2011).

3.5.2 ENVIRONMENTAL CONSEQUENCES

3.5.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1). Construction noise from future development would cause temporary and short-term increases to the ambient sound environment. Occupational Safety and Health Administration requirements would apply. Construction activities would occur in active industrialized areas and in areas where there are no nearby sensitive receptors. Table 3-3 lists typical noise emissions from heavy equipment.

Table 3-3. Typical noise emissions from heavy equipment (FHWA 2006).

Equipment	Typical noise level 50 feet from source (dBA)	Typical noise level 3,000 feet from source (dBA)
Backhoe	78	42
Crane	81	45
Dump truck	76	40
Bulldozer	82	46
Excavator	81	45
Front-end loader	79	43
Jackhammer	90	54

In relation to noise from heavy equipment (Table 3-3), under free-field conditions in which there are no reflections or additional attenuation (reductions), a point-source sound decreases at a rate of 6 decibels each time the distance from the source doubles (WADOT 2001). For example, a conservative noise emission estimate from a jackhammer would be 54 A-weighted decibels at the nearest residence (3,000 feet). However, the actual noise would probably be lower in the field, where objects and topography would cause further noise attenuation. Although there are residential areas near the PGDP (the closest residence is about 3,000 feet to the east of the fence around the industrial area), adverse impacts from increased noise emissions from construction equipment and activities in relation to current levels would be intermittent and temporary.

Offsite traffic is a source of noise at the site boundaries. Existing site-related traffic includes employee vehicles and trucks, which contribute to traffic on nearby roads and the associated traffic noise. DOE assumed that construction would require 16 trucks trips in and out of the site each day. Noise from this level of truck traffic would be minimal, especially in comparison to current traffic levels at the PGDP site, as presented in Section 3.11.

If future users conducted site construction in the undeveloped lands on the outer perimeter, the distance of a potential noise source to a residential receptor could be closer than 3,000 feet. While the surrounding area of the PGDP site is primarily rural, there are several residences near the eastern property line. Noise compatibility is generally a consideration when planning development and can be a factor in obtaining the appropriate construction permits and operating licenses as part of applicable zoning regulations to which the private owners or developers would be subject.

Operations. Industrial uses that involved heavy processing, manufacturing, assembly, and fabrication plants would likely generate more noise than commercial uses such as offices, service establishments, and storage or warehousing facilities. Potential noise impacts from the conceptual project would depend on the location of the facility. If future users conducted site operations in the undeveloped lands on the outer perimeter, the distance of a potential noise source to a residential receptor could be closer than 3,000 feet. While the surrounding area of the PGDP site is primarily rural, there are several residences near the eastern property line. Noise compatibility is generally a consideration when planning development and can be a factor in obtaining the appropriate construction permits and operating licenses as part of applicable zoning regulations to which the private owners or developers would be subject.

3.5.2.2 Recreation and Wildlife Management Uses

With the exception of ongoing DOE activities, there would be no or minimal noise impacts from recreational or wildlife management activities in the developed or undeveloped areas. For the developed areas, noise for recreation and wildlife management uses would be less than current and historical noise levels. Traffic levels and corresponding noise levels would be less than those from current PGDP site activities. For the undeveloped areas, noise for recreation and wildlife management uses would be

consistent with current conditions and would have negligible impact. Noise from small motor vehicles would be intermittent in the undeveloped area and consistent with current activity levels because the WKWMA already has roads that are used by motor vehicles. Construction of facilities, if any, under this use would likely be less than under either of the other uses. Any noise from construction-related activities would be short in duration.

3.6 Geology and Soils

3.6.1 AFFECTED ENVIRONMENT

3.6.1.1 Geology

The PGDP lies near the northern boundary of the Mississippi embayment of the Gulf Coastal Plain Province. The Mississippi embayment is a large, nearly north-south sedimentary trough that received sediments during the Cretaceous (145 to 65 million years ago) and Tertiary (65 to 2.6 million years ago) geologic periods. A thick deposit of sand (up to about 270 feet) beneath the PGDP called the McNairy Formation formed during the Cretaceous Period when the PGDP area was a coastal marine environment. This formation has frequent lenses of silt and clay in its upper portions. Similar sediments deposited in the early Tertiary period are named the Clayton Formation, but samples of this formation are generally indistinguishable from the underlying McNairy Formation. As a result, the two formations are often referred to simply as the McNairy Formation (LATA 2012a). The bedrock beneath the McNairy Formation consists of Mississippian limestone and shale (DOE 2004).

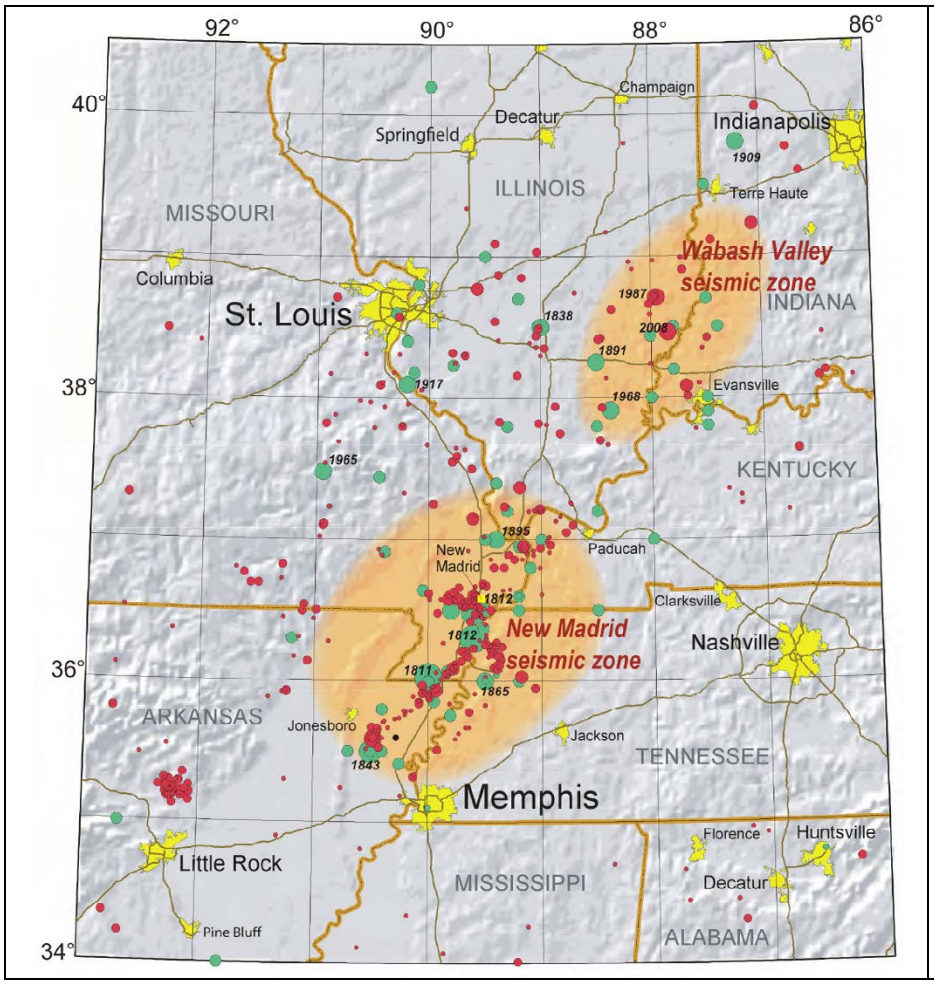
The Porters Creek Clay, which deposited in marine and brackish environments, overlies the McNairy Formation and in the PGDP area consists primarily of silt with sand and clay interbeds. After deposition, water from the ancestral Tennessee River basin eroded away most of the Porters Creek Clay beneath the PGDP. The Porters Creek Clay remains only beneath the southern portion of the PGDP. The McNairy Formation and the Porters Creek Clay uniformly dip 30 to 35 feet per mile to the south-southwest (LATA 2012a).

A unit designated as Continental Deposits lies directly on the erosional surface of the Porters Creek Clay, where still present, and the McNairy/Clayton Formation. The Continental Deposits resemble a large low-gradient alluvial fan that deposited where the ancestral Ohio and Tennessee Rivers came together. Erosion and reworking of alluvial fan deposits modified the thickness and distribution of the unit, but it is generally present in a lower gravel or sandy gravel unit and an upper clay-sand unit (DOE 2004). The upper portion of the Continental Deposits unit was also affected by retreating Pleistocene glaciers, which resulted in lake formation in the ancestral Tennessee River valley. In addition, lake deposits that consist predominantly of silt are present in the upper Continental Deposits (LATA 2012a).

Layers of loess (wind-blown silt from receding glaciers), blanketed the entire region that includes western Kentucky and represents the top layer of geologic materials at the PGDP. The combined thickness of upper Continental Deposits and loess at PGDP is commonly about 60 feet (LATA 2012a). The topography of western Kentucky consists of gently rolling terrain between 330 and 550 feet above sea level. Within this area, the PGDP is relatively flat with an elevation change of about 10 feet inside the fenced area (DOE 2004).

Seismicity

The PGDP is in the New Madrid seismic zone, which is the location of some of the largest earthquakes known to have occurred in North America (Figure 3-5). The largest recorded earthquakes in this seismic zone happened in 1811 and 1812 in and near New Madrid, Missouri. The town of New Madrid, about 70 miles southwest of the PGDP site, was completely destroyed during these earthquakes. Since the 1811



Legend

Earthquake locations are shown as green and red circles. Red circles indicate earthquakes that occurred from 1974 to 2002 with magnitudes greater than 2.5. Green circles indicate earthquakes that occurred before 1974. Larger circles represent larger earthquakes.

Figure 3-5. Map of New Madrid and Wabash Valley seismic zones (USGS 2012a).

and 1812 events, the largest earthquakes had magnitudes of 6.0 and 6.2 and occurred in 1843 and 1895, respectively, and seven additional events with magnitudes greater than 5.0 have occurred. Since 1895, the zone has experienced more than 4,000 earthquakes, most too small to be felt (DOE 2004).DOE has studied the seismic hazards at the PGDP extensively. DOE evaluated an earthquake with a return period of 250 years and determined it would involve a peak ground motion[1] of 0.15 times the acceleration of gravity (DOE 2004). People would sense minor shaking from an earthquake of this size, but damage would be unlikely (USGS 2013a). According to Kentucky Geological Survey evaluations, the maximum credible earthquake in the Paducah area using this approach is a peak ground motion of 0.3 times the acceleration of gravity (KGS 2010). This size of earthquake would result in very strong shaking and have the potential to cause moderate damage (USGS 2013a).

3.6.1.2 Soils

Table 3-4 provides approximate percentages of the general soil types in the developed and undeveloped areas of the PGDP site from soil unit mapping by the Natural Resources Conservation Service http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). As the data in the table show, the natural soil of the area is a silt loam or silty loam.

1. Peak ground motion is a measure of how hard the earth shakes in a given geographic area.

Table 3-4. PGDP area soil types per soil surveys (NRCS 2013a, 2013b, 2013c).[a]

Description	PGDP industrial area (%)	Entire site[b] (%)
Silt loams or silty loams of several different soil series[c]	32%	70%
Urban land (with backfill as applicable)	60%	26%
Dumps, pits, and gravel (with backfill as applicable)	6%	3%
Water	1%	2%

a. Totals might not equal 100 percent due to rounding.
b. Includes the developed industrial area and the undeveloped area that is part of the WKWMA.
c. Specific soil series identified in the Natural Resources Conservation Service soil survey data include Callaway, Falaya-Collins complex, Grenada, Loring, Loring-Purchase complex, Routon, Vicksburg, and Waverly.

Each of the silt loam or silty loam soil types in the DOE site qualifies as prime farmland or prime farmland if drained, as long as slopes are identified as being less than 6 percent. On the developed industrial center of the PGDP site, 31 percent of the land qualifies as prime farmland or prime farmland if drained, and in the undeveloped land associated with the WKWMA the qualifying land is 63 percent.

3.6.2 ENVIRONMENTAL CONSEQUENCES

3.6.2.1 Industrial Use

Construction. Future use of the PGDP site for industrial uses could involve land-disturbing activities such as clearing, grading, and otherwise disturbing and changing the topography of the land. Such actions would not affect the site's underlying geologic formations. The site is subject to identified seismic hazards from the New Madrid seismic zone. New structures would have to be designed and constructed in accordance with appropriate seismic standards.

To evaluate potential environmental impacts of industrial use to geology and soils, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1). This construction would require the use of heavy equipment (for example, bulldozers, excavators, and backhoes) and involve disturbance of soil in and around building footprints.

Use of best management practices during construction would mitigate the potential for soil erosion. Much of the disturbed area would consist of fill and reworked material from past construction actions. Even if actions were to occur in the undeveloped areas of the WKWMA with native soil, the amount of disturbance would be minor in comparison with the amount of native soils in the vicinity. Therefore, impacts to native soils would be minor. Construction might disturb or remove topsoil, but normal best management practices would involve stockpiling such soil for replacement after construction. Further, Kentucky and local construction permits would require best management practices to minimize soil erosion as a component of runoff control during construction or other soil disturbing actions.

The *Farmland Protection Policy Act* (7 U.S.C. 4201 et seq.) requires federal agencies to consider the effects of activities that would convert farmland to nonagricultural use. The land DOE is considering for transfer is not agricultural. The property is not subject to restrictions under the *Farmland Protection Policy Act*. The portions of the PGDP that have soil types that could qualify as prime farmland are relatively small The potential impact of removing this land from future use as farmland would be minimal because of the small amount of undeveloped land at the site in the context of the availability of similar farmland in the surrounding area. Further, transferring the real property would not preclude use of land outside the industrial area as farmland. If DOE transferred the real property to a nonfederal entity, the *Farmland Protection Policy Act* would no longer be applicable.

The environmental cleanup actions DOE is implementing at the PGDP would continue. The nature and extent of planned actions could eventually affect which portions of the real property DOE makes available for transfer. DOE's compliance with CERCLA requirements, as discussed in Section 1.3, would ensure that any future industrial use would not hinder remediation efforts.

Operations. Operation of the conceptual project or other new industrial facilities on transferred land would last longer than demolition and construction but would pose very little impact on geologic and soil resources. Potential soil erosion is discussed in Section 3.7 below. Future use of the PGDP would be consistent with existing county zoning ordinances and development guidelines; no further impacts to geologic and soil resources would be likely.

3.6.2.2 Recreation and Wildlife Management Uses

Changes to the developed and undeveloped portions of the site for recreation and wildlife management also could involve land-disturbing activities, and the potential impacts and mitigating measures described for industrial use would still be applicable. That is, there would be requirements to protect against soil erosion during the disturbances, and measures to stockpile and reuse top soil would be expected. At this time, DOE has not estimated acreage for land disturbance associated with recreation or wildlife management uses. As with industrial use, more potential impacts would be likely in the undeveloped areas of the site. However, construction of facilities, if any, under this use would likely be less than under industrial use. If structures on the site were demolished, it would be put into a more natural condition where soils would be stable with little or no need for recurring maintenance. As with the uses above, DOE would continue its environmental cleanup actions until they were completed.

3.7 Water Resources

3.7.1 AFFECTED ENVIRONMENT

3.7.1.1 Surface Water

Overview

The PGDP site is about 3.5 miles south of the Ohio River in the western end of the Ohio River basin, which ends at the confluence of the Ohio and Mississippi Rivers about 35 miles downstream as the river flows (LATA 2012a). Drainage at the site, as well as in the surrounding area, is basically toward the Ohio River. The site is within the Bayou Creek-Ohio River watershed (Hydrologic Unit Code 051402060701), which is the red-shaded area in Figure 3-6.

Most of the PGDP site lies between Bayou and Little Bayou Creeks (Figure 3-6), such that the western side drains to one and the eastern side to the other. The DOE-owned property that makes up the site extends outside of the area between the two creeks, but is still within the area drained by the two creeks. Bayou Creek is a perennial stream with a length of about 9 miles before flowing into the Ohio River; Little Bayou Creek is an intermittent stream with a length of about 7 miles before it converges with Bayou Creek shortly before draining into the Ohio River (LATA 2012a).

Table 3-5 provides flow information for the Ohio River, Bayou Creek, and Little Bayou Creek. Flow in both creeks fluctuates greatly as a result of precipitation, but much of the flow in both streams comes from PGDP effluents (DOE 2004) and this is particularly true of Little Bayou Creek (LATA 2012a). PGDP effluents are discussed further below.

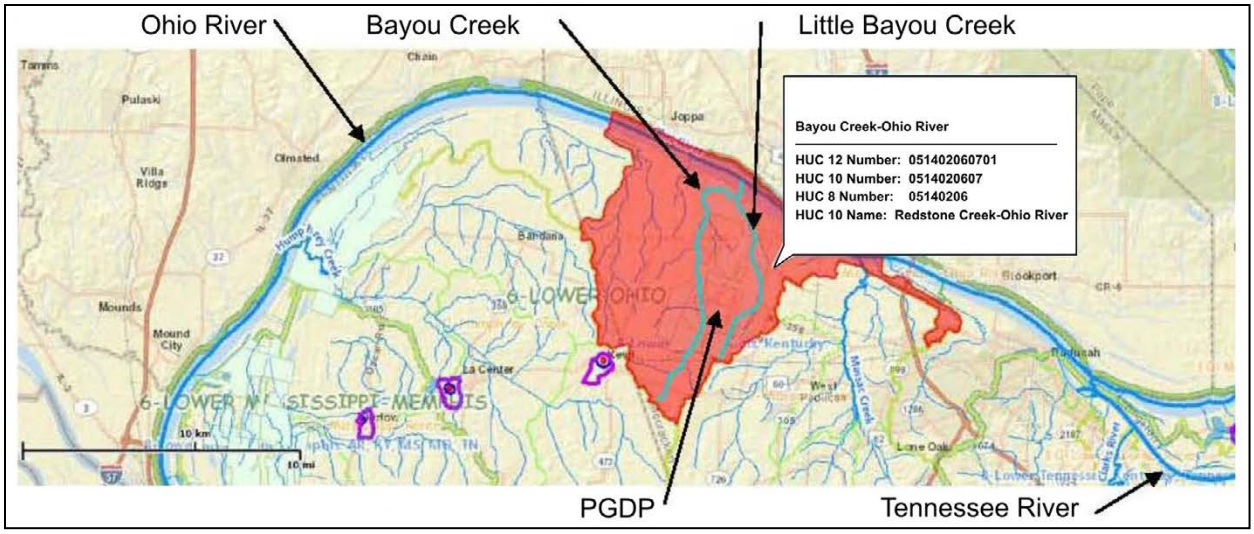


Figure 3-6. Bayou Creek-Ohio River watershed and area surface waters (modified from KDEP 2013a).

Table 3-5. Flow information for the Ohio River, Bayou Creek, and Little Bayou Creek.

Parameter	Ohio River[a]	Bayou Creek[b]	Little Bayou Creek[b]
Period of record	1928 through 2011	2009 through 2011	2009 through 2011
Record type	Continuous	15 discrete events	14 discrete events
Average flow in MGD[c]	180,300	7.1	2.5
Maximum flow in MGD[c]	282,200 (in 1979)	18.1	10.8
Minimum flow in MGD[c]	77,800 (in 1931)	1.9	0.8
Peak flow in MGD	1,200,000 (on 02/01/1937)	Not applicable	Not applicable
Monitoring location	Near TVA Shawnee Fossil Plant or bridge 2 miles further up stream	DOE monitoring location L6, midway between PGDP and Ohio River	DOE monitoring location L11, midway between PGDP and Ohio River

MGD = million gallons per day.
a. USGS 2012b.
b. LATA 2010, 2012a, 2012b.
c. Average, maximum, and minimum flows for the Ohio River are average annual values (for example, the year with the highest annual average flow was 1979 when the average flow was 282,000 MGD).

Surface Water Quality

Section 305(b) of the *Clean Water Act* (33 U.S.C. 1251 *et seq*.) requires states to develop and periodically update an inventory of the water quality of all water bodies in the state. Section 303(d) of the Act requires states to develop and periodically update an inventory of water bodies that do not meet water quality standards. Table 3-6 lists designated uses and general water quality status for surface waters near the PGDP based on the *Integrated Report to Congress on the Condition of Water Resources in Kentucky, 2010* (KDEP 2010), which integrates both Section 305(b) and Section 303(d) report requirements. The report provides evaluations for many different segments of the Ohio River; Table 3-6 lists results for the Ohio River segment adjacent to the area of the PGDP and into which Bayou and Little Bayou Creeks drain.

Kentucky has designated all of the water bodies and segments in Table 3-6 as impaired to some degree and, as a result, their water quality is not fully supportive of the applicable designated uses. Total maximum daily loads, which represent the total amount of a contaminant a specific water body can assimilate while still meeting applicable designated uses (KDEP 2010), are under development for both Bayou and Little Bayou Creeks. Once Kentucky establishes such loads, an appropriate course of action to

Table 3-6. Surface-water quality and designated uses in the PGDP vicinity (KDEP 2010 and 401 KAR 10:026).

Water body	Segment identifier and location	Designated uses[a]						Water quality assessment results – impaired waters
		WAH	FC	PCR	SCR	DWS	OSRW	
Ohio River Basin								
Ohio River	Ohio River Mile 925.8 to 981.0 (convergence with the Mississippi River), adjacent to Livingston (west portion), McCracken, and Ballard Counties in Kentucky.	X	X	X	X	X	X	• Only partially supportive of FC use due to the presence of: – Metal contaminants (mercury); and – Organic contaminants (dioxin and PCBs). • Suspected sources are unknown.
Bayou Creek	River Mile 0.5 to 11.9 (convergence with the Ohio River).	X	X	X	X	X		• Only partially supportive of WAH use due to the presence of: – Radiological contaminants (beta particles and photon emitters and gross alpha); – Metal contaminants (copper, lead, and mercury); – Nutrient/eutrophication biological indicators; and – Sedimentation/siltation. • Suspected sources: inappropriate waste disposal, industrial point source discharge, nonirrigated crop production.
Little Bayou Creek	River Mile 0.0 to 7.2 (convergence with Bayou Creek).	X		X	X	X		• Not supportive of WAH or FC use due to the presence of the following: – Radiological contaminants (beta particles and photon emitters and gross alpha); – Metal contaminants (copper and lead). • Suspected sources: inappropriate waste disposal, industrial point source discharge.

PCB = polychlorinated biphenyl; TMDL = total maximum daily load.

a. X indicates the designated use is applicable to the identified stream segment.
Designated use classifications:
WAH = Warm water aquatic habitat
FC = Fish consumption
PCR = Primary contact recreation
SCR = Secondary contact recreation
DWS = Domestic water supply
OSRW = Outstanding state resource water

control or reduce contaminants to improve water quality can be developed. The partial impairment identified for the nearby segment of the Ohio River, from unknown sources, does not warrant the development of total maximum daily load at this time.

The assessment methodology in Kentucky's Integrated Report indicates that many water body segments had monitoring data for only one designated use, typically aquatic habitat (KDEP 2010). In the cases of Bayou and Little Bayou Creeks, monitoring data indicate water quality was not supportive of the designated "warm water aquatic habitat" use (Table 3-6). The report classifies most other designated uses for these two streams as not being assessed due to insufficient or no data available. The exception is the "fish consumption" use, which Bayou Creek supports and Little Bayou Creek does not. For the Ohio River, the availability of more monitoring data supports more detailed assessment and, with the exception of the impairment Table 3-6 lists, the water quality of the identified river segment supports all of its intended uses.

Water Use

Table 3-7 summarizes water use in McCracken County in 2005. In addition to the types of activities for which the water was used, the table identifies if the water came from groundwater or surface water. As the data in the table show, thermoelectric use dominates water use in the county. The Tennessee Valley Authority (TVA) Shawnee Fossil Plant uses water from the Ohio River for once-through cooling. With the thermoelectric category included, about 0.1 percent of water used in the county comes from groundwater. Excluding the thermoelectric category, the percentage of the water coming from groundwater is much higher, but it still represents a minor portion of the county's water use. With the thermoelectric category and PGDP excluded, more than 90 percent of the water used in the county came from public water systems. The largest public water provider in the county is Paducah Water, a

Table 3-7. 2005 water use by source in McCracken County, Kentucky.

	Water source		**Totals (percent of overall total)**	
Water use category	**Ground (MGD)**	**Surface (MGD)**	**With thermoelectric [MGD (%)]**	**Without thermoelectric [MGD (%)]**
Water use without the PGDP (USGS 2013b)				
Public water supplies				
Domestic uses	0.36	3.40	3.76 (0.29%)	3.76 (44.5%)
Industrial, commercial, and losses	0.37	3.54	3.91 (0.30%)	3.91 (46.3%)
Domestic (self-supplied)	0.55	0	0.55 (0.04%)	0.55 (6.5%)
Irrigation	0.08	0.04	0.12 (0.01%)	0.12 (1.4%)
Livestock	0.01	0.07	0.08 (0.01%)	0.08 (1.0%)
Aquaculture	0.01	0	0.01 (0.00%)	0.01 (0.1%)
Industrial (self-supplied)	0.02	0	0.02 (0.00%)	0.02 (0.2%)
Thermoelectric	0	1,292.03	1,292.03 (99.35%)	Not applicable
Totals with thermoelectric (percent of total)	1.40 (0.1%)	1,299.08 (99.9%)	1,300.48 (100%)	8.45 (100%)
Totals without thermoelectric (percent of total)	1.4 (16.6%)	7.05 (83.4%)		0.0 (0%)
PGDP water use (USEC 2013)				
Industrial processes and nontransient, noncommunity drinking water system		26		26

MGD = million gallons per day.

municipally owned utility. According to Kentucky records, Paducah Water operates seven wells but an intake in the Ohio River is its primary source of water. The West McCracken County Water District is the only other community water system in the county, but it purchases its water from Paducah Water.

At present, DOE operates a nontransient, noncommunity water system at the PGDP site and gets its water from the Ohio River (KDEP 2013b) at an intake near the Shawnee Fossil Plant north of the facility (DOE 2004). With the cessation of uranium enrichment operations, the water treatment plant can be operated at a lower capacity or water can be purchased from other sources. The amount of water withdrawn from the Ohio River varied depending on the plant's process load, but it averaged about 15 to 26 million gallons per day (Table 3-7) with peaks of up to 30 to 32 million gallons per day during the 8-year period through 2012. The water is treated on the site, and about 15 percent of the flow receives additional treatment and goes to the sanitary water system; the rest goes to support plant processes, primarily once-through and recirculating cooling systems (DOE 2012a).

Cairo, Illinois, is the closest downstream community that obtains water for drinking from the Ohio River (LATA 2012a). Cairo, at the confluence of the Mississippi and Ohio Rivers, is about 30 miles downstream (as the river flows) of where surface drainage from the PGDP site enters the Ohio River.

Local Discharges to Surface Waters

PGDP wastewater consists of sanitary streams, permitted landfill surface run-off, and radioactive process-related liquid effluents. Most wastewater is processed on site in treatment facilities and discharged to Bayou Creek or Little Bayou Creek through outfalls that are regulated under Kentucky Pollutant Discharge Elimination System permits (DOE 2004). At present, the Plant's effluent discharges through 15 outfalls that are regulated under two permits (KY0102083 and KY0004049) issued to DOE and its contractors.

More information on the types of discharges going to the various outfalls is available in the *Paducah Annual Site Environmental Reports* (LATA 2012a), "DOE Paducah Site Tour" (DOE 2012a), and the Kentucky Pollutant Discharge Elimination System permits (KDEP 1998). A map in the "Paducah Gaseous Diffusion Plant" presentation shows the locations of PGDP surface water outfalls (DOE 2012b).

Surface Waters and Environmental Cleanup Activities

As described in Section 3.6.1.2, DOE is planning and implementing cleanup activities at the PGDP under several scopes of action to address the various areas of concern DOE has identified on the site. DOE has grouped these areas into media-specific operable units, including one for surface waters. Under the Surface Water Operable Unit, DOE is investigating, evaluating, and, if contamination is present at unacceptable levels, remediating surface water, sediments, and other media associated with ditches and creeks that might have been affected by PGDP activities. DOE performs these actions in accordance with a FFA with EPA and Kentucky, who have the right of review and approval for CERCLA documents under the FFA. Metals, polychlorinated biphenyls, and radionuclides are the primary contaminants of potential concern for the surface water areas, but investigations will also consider volatile organic compounds.

3.7.1.2 Groundwater

Groundwater Flow System

On a regional basis, the PGDP site is near the northern extent of the Mississippi embayment (the wide sedimentary trough Section 3.6.1 describes), which extends south all the way to the Gulf of Mexico. The Mississippi embayment aquifer system is characterized by extensive and massive beds of sand. The system consists of a group of unconsolidated and consolidated sediment aquifers that are generally separated by confining units or interbedded layers of fine-grained sediment that restrict vertical flow.

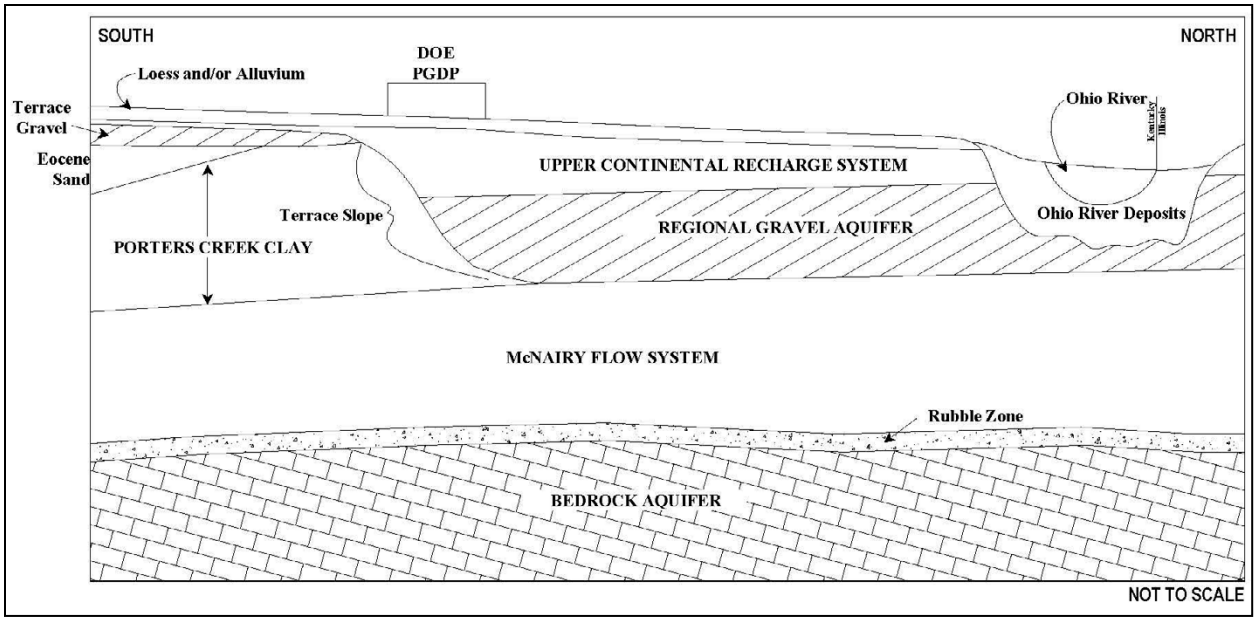


Figure 3-7. Relationship of hydrogeologic units near the PGDP site (PRS 2008).

These aquifers are a major source of freshwater in the region, whereas the bedrock that underlies them generally contains saltwater. Figure 3-7 is a schematic of the groundwater flow system in the PGDP area.

The following statements briefly describe the primary components of the flow system, from bottom to top (deepest to shallowest) and include information on the presence of contamination, if any, from PGDP activities:

- Bedrock Aquifer. There is no known contamination associated with PGDP in the bedrock aquifer, which is 335 to 350 below the ground surface (PRS 2008).

- McNairy Flow System. Near PGDP, the McNairy flow system has significant amounts of silt and clay that make it less useful as an aquifer (PRS 2008); it is about 225 feet thick (LATA 2012a) and is first encountered about 100 feet below the surface. Its groundwater flows to the north and northwest (PRS 2008). DOE has found minor amounts of PGDP-associated contamination, consisting of trichloroethylene, cis-1,2,-dichloroethene, beta activity, and technetium-99, in the upper portions of McNairy flow system.

- Regional Gravel Aquifer. In the PGDP area, this aquifer is the uppermost and primary aquifer; it is 30 to 70 feet thick and flows northward toward the Ohio River (LATA 2012a). This aquifer has been the most affected by contamination (trichloroethylene and technetium-99) from past PGDP operations.

- Porters Creek Clay, Terrace Gravel, and Eocene Sands. The Porters Creek Clay pinches out the Regional Gravel Aquifer in the southern part of the DOE-owned property and is overlain by Terrace Gravel and Eocene sands. DOE has found contamination from past PGDP activities in these sands and gravels in the industrial portions of the site (PRS 2008).

- Upper Continental Recharge System. The Upper Continental Recharge System consists mainly of clay silt with interbedded sand and gravel and generally recharges the underlying Regional Gravel Aquifer (LATA 2012a). DOE has found contamination from past PGDP activities in the upper continental recharge system in the industrial portions of the site (PRS 2008).

Groundwater Use

As indicated above and shown in Table 3-7, uses of groundwater in McCracken County are relatively minor. About 10 percent of the public or municipal water supply in the county comes from groundwater. The next largest use of groundwater is for domestic purposes by way of private wells. Although groundwater was the primary source of drinking water for residents and industries in the area of the PGDP in the past, many of the residents are on municipal water supply (West McCracken County Water District).

Groundwater and Environmental Cleanup Activities

The groundwater beneath the PGDP has some areas of contamination from past operations. DOE first discovered offsite contamination in the regional gravel aquifer groundwater in 1988 and since that time has implemented various response actions to address the issues. DOE's response included action to provide municipal water in areas of offsite groundwater contamination from PGDP activities. DOE has also taken actions to contain and reduce the contamination plumes by pumping and treating contaminated water and reducing contamination sources.

3.7.1.3 Floodplains and Wetlands

Floodplains

Flooding in the area is associated with Bayou Creek, Little Bayou Creek, and the Ohio River. Maps of the calculated 100-year flood elevations show that all three drainage systems have 100-year floodplains within the DOE boundary at the PGDP site, but not within the industrialized area (FEMA 2013). Figure 3-8 shows the 100-year flood zones.

Wetlands

Figure 3-9 shows that the National Wetlands Inventory identifies few potential wetlands in the PGDP area. For the most part, the wetlands appear to be limited to ponds the plant uses in its operations. Blue shading shows each of the potential wetland areas within the PGDP industrial area, which the Service has designated as Freshwater Ponds. Although the figure does not reflect it, the Service has more specifically identified these wetlands as PUBH, indicating they are palustrine in nature (that is, a marsh or marshy wetland, generally without flowing water) with unconsolidated bottoms and are permanently flooded. Some have additional coding that indicates they are excavated, diked, or otherwise impounded. The only other type of wetlands in the area are the green-shaded Freshwater Forested/Shrub Wetlands, in areas to the west, south, and east of the industrial center of the developed area of the PGDP. The Service has designated these as PFO1A wetlands, which indicates they are palustrine in nature, forested with broad-leaved deciduous trees, and temporarily flooded.

Although the National Wetlands Inventory shows a relatively minor number of potential wetlands in the PGDP area, more detailed studies have determined there are scattered areas totaling about 5 acres of jurisdictional wetlands in drainage ditches within the fenced industrial center of the PGDP and large numbers of wetlands throughout the entire PGDP area (ANL 2004a). There are an estimated 400 acres of

wetlands on the PGDP site (USACE 1994a, 1994b). These wetlands areas were characterized as including forested wetlands, ponds, wet meadows, vernal pools, and wetlands converted to agriculture (ANL 2004a). The effort by the Corps of Engineers was considered a planning level delineation because wetlands identification extended only to the nearest elevation contour interval; the locations do not represent definitive jurisdictional boundaries (USACE 1994b).

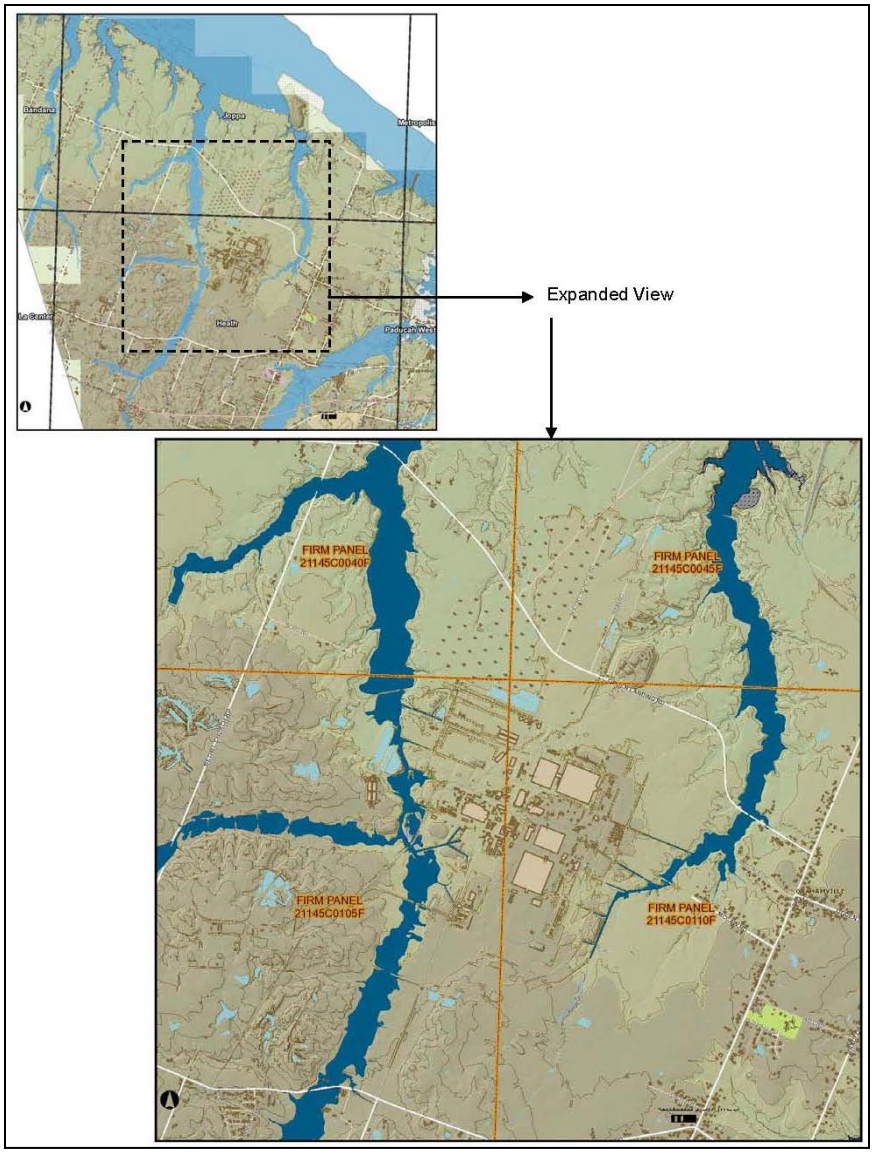


Figure 3-8. Flood zones associated with a 100-year flood in the PGDP area.

3.7.2 ENVIRONMENTAL CONSEQUENCES

3.7.2.1 Industrial Use

Surface Water

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1). Construction activities on transferred real property (developed or undeveloped) would likely involve areas of disturbed or newly uncovered soil, which would tend to decrease runoff for a period of time but would also increase the potential for runoff to carry sediment to drainage channels. Construction would also involve the presence of heavy equipment with the potential for leaks and spills of fuels or other petroleum products that could be carried away by runoff or sink into the ground. Because construction would disturb more than 1 acre, the future owners would require a Kentucky Division of Water stormwater discharge permit. The permit would require the applicant to develop plans and implement measures to

Figure 3-9. Identified wetlands in the PGDP area from the National Wetlands Inventory.

keep contaminants and sediment out of runoff. The permit would require best management practices such as "diversion, detention, erosion control, sediment traps, gravel construction entrances, covered storage, spill response, stream buffer zones, and good housekeeping" (KDOW 2011). Construction sites that would disturb less than 1 acre would still require a stormwater discharge permit if they were part of a larger, common plan of development (KDOW 2011).

The developed portion of the PGDP site consists of relatively dense impermeable surfaces (buildings, storage pads, roads, etc.) and, as a result, they produce much more runoff than a comparable area with natural vegetation. Over the long term, industrial uses of the real property would likely result in runoff quantities similar to current conditions. Less acreage of impermeable surfaces would result in less runoff, and more acreage of impermeable surfaces would result in more runoff. Because the drainage areas are small, changes in runoff from the PGDP area could have significant effects on the amount of water that would reach Bayou Creek and Little Bayou Creek, but changes to the amount of water in the Ohio River would be negligible. Less runoff in the Bayou Creek and Little Bayou Creek drainage channels could have minimal adverse impacts on vegetation and wildlife in those areas, but there are no other uses of those waters before they discharge to the Ohio River.

If construction of the conceptual project occurred on an undeveloped portion of the DOE real property, site preparation and project construction would result in soil disturbance up to 25 acres. The future developer would need to prepare a stormwater pollution prevention plan such that best management

practices for erosion and sediment control would be implemented during the construction of the project. A future owner or user would commit to using the practices in conformance with a project-specific plan. These practices could include containing excavated material, using silt fences, protecting exposed soil, stabilizing restored material, and revegetating disturbed areas.

Operations. PGDP has historically drawn a large volume of water from the Ohio River to support enrichment operations. Future activities on transferred real property, such as the conceptual project, would most likely withdraw much less water and result in an overall decrease in the area's use of surface water. Even if future users of the real property connected to the local municipal water lines, the source of that water is still predominantly surface water. Reduction in water use over the long-term would represent an environmental benefit, but because there are no identified issues with the total amount of current water withdrawals from the Ohio River in the region, the benefit would be minor.

Industrial or nonindustrial process wastewaters from new facility uses would also be subject to all necessary pretreatment requirements to meet the applicable treatment and discharge standards. Based on the assumption that new users would operate within all applicable environmental, statutory, and regulatory requirements, future operations would not be anticipated to adversely affect surface waters.

Groundwater

Construction. For the conceptual project and other industrial uses, DOE would continue to restrict use of groundwater at the site for construction. Its use could be prohibited via a lease restriction or condition of the deed or title transfer. Because the existing water system uses water from the Ohio River, the restriction would not present a hardship to future site users. There would be no impacts to groundwater from the construction of new facilities.

Operations. For the conceptual project or other future industrial uses, DOE could continue to restrict use of groundwater at the site for future operations. Groundwater use could be prohibited via a lease restriction or condition of the deed or title transfer. Because the existing water system uses water from the Ohio River, the restriction would not present a hardship to future site users. If future users of the site choose to connect to the local municipal water distribution system, that could involve an increase in use of regional groundwater because groundwater is a source for Paducah's water system. However, the impact would be small because groundwater is only a minor source. Environmental standards would prohibit any new users from discharging contaminants to groundwater.

As described previously, different uses of the PGDP site could result in changes to runoff. If future uses resulted in a larger area of the site having vegetative cover rather than impermeable surfaces, the resulting decrease in runoff could lead to an increase in groundwater recharge. This would be an environmental benefit, but the amount of recharge area would be minor in comparison to the amount of currently undeveloped surface area or the amount of agricultural activities in the vicinity.

Floodplains

Construction. The transferee would address potential impacts to floodplains before choosing a site for an industrial project like the conceptual project. The 100-year flood zones, or floodplains, for both Bayou Creek and Little Bayou Creek extend into DOE property (Figure 3-8), and actions to transfer PGDP property could affect these flood zones. The existing developed areas of the plant, the access routes, and the infrastructure generally avoid the flood zone areas, so there would likely be little benefit to future property users to construct or otherwise work in the flood zones. If they did, however, Kentucky regulates construction and development in floodplains and would require floodplain permits for "dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations, or relocations, and impoundments" (KDOW 2010). A primary purpose of this permitting is to ensure protection of structures from flood damage, but it also ensures that construction or filling does not reduce

the storage capacity for floodwaters in the floodplain. Given the requirement to obtain Kentucky approval for any actions within the 100-year floodplain, it is unlikely industrial uses would lead to adverse impacts to the beneficial values of the Bayou Creek and Little Bayou Creek floodplains.

As required by 10 CFR Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements," DOE must evaluate any action it might take in a floodplain to ensure appropriate consideration of floodplain hazards and floodplain management. If DOE planned to transfer real property in a floodplain, the Department would identify those uses that are restricted under applicable floodplain regulations and attach other appropriate restrictions to the uses of the real property and inform the potential transferee of the hazards associated with locating facilities or structures in the floodplain. The transfer documentation would also identify those uses that are restricted under applicable floodplain regulations. Appropriate restrictions would be attached to the deed pursuant to 10 CFR 1022.21.

Operations. The transferee would address potential impacts to floodplains before choosing a site for the conceptual project. After construction, improvement plans that might affect floodplains would require additional review and approval. Therefore, operational activities are anticipated to have little to no impacts on floodplains.

Wetlands

Construction. Construction actions related to the 500,000-square-foot facility (see Table 2-1), or other future industrial uses, could have the potential to affect several wetlands within the developed area (see Figure 3-1) of the PGDP and a larger number of wetlands in the remainder of the DOE-owned real property in the undeveloped areas. The 1994 U.S. Army Corps of Engineers study identified these wetlands in the undeveloped areas as being jurisdictional wetlands. That is, they qualify as Waters of the United States, which are protected under Section 404 of the Clean Water Act. Therefore, if future actions required filling or draining of any of these wetlands, the responsible party would have to obtain a Section 404 Permit from the Corps of Engineers. The work would be subject to whatever mitigation measures (for example, wetland restoration or replacement) the permit required. To establish definitive boundaries for the wetlands, it is likely the party proposing the work would need to perform a detailed wetlands delineation of the project site. In addition, Kentucky requires a Clean Water Act Section 401 Water Quality Certification for actions that involve the placement of dredged or fill materials into wetlands (KDOW 2013). This certification affirms that the action will not violate Kentucky's water quality standards.

Although new uses of the DOE real property could affect individual wetlands, the permit from the Corps of Engineers and the certification from Kentucky would ensure that impacts were minimized to the extent practicable. In addition, the Corps could require restoration or replacement of wetlands damaged or lost due to the action as a condition of the permit.

Operations. Wetland impacts associated solely with the operation of the conceptual project would be minimal. If the future owner proposed development or other actions that could directly or indirectly impact any wetlands, such as by changing drainage patterns or causing increased erosion or sedimentation, such actions would be subject to permitting requirements and the associated controls to protect down-gradient areas.

As described above for floodplains, 10 CFR Part 1022 requires DOE to consider wetlands protection in its decisionmaking. The Department would identify the locations of wetlands and inform the transferee. It would be the responsibility of the transferee to coordinate with the U.S. Army Corps of Engineers and Kentucky to ensure that wetlands activities would be in compliance with wetlands regulations.

3.7.2.2 Recreation and Wildlife Management Uses

Surface Water

Use of the PGDP real property (developed and undeveloped areas) for recreation and wildlife management would involve less impact to surface water over the long term than industrial uses. Recreation and wildlife management uses would be likely to involve more natural conditions than under industrial or commercial uses, with more vegetation and less runoff, less potential for adverse impacts to surface water quality, and less water use. This could change over short durations or small portions of the site as uses transitioned or if actions were allowed that adversely affected vegetation. However, vegetation would reestablish, and DOE assumed use of the site for recreation and wildlife management would not involve as much development or impermeable surface areas as current conditions. If recreational uses included landscaped areas, there could be applications of chemicals for fertilizer and weed control. As with industrial and commercial uses, DOE's site cleanup activities would continue under this use and would likely result in delaying use of some portions of the site for recreation and wildlife management purposes until those cleanup actions were complete.

Groundwater

Recreation and wildlife uses of the PGDP site could have more impact on groundwater than the other uses, but it would be limited to increased recharge (correlating to decreased runoff), so it would be a beneficial effect.

Floodplains

It is reasonable to assume that recreation and wildlife uses of the PGDP site would involve little to no development in flood zones because the objective would be to keep areas in a more natural state. As a result, there would be little or no impacts to floodplains. Regardless of the location of development, future users would be subject to the same requirement to obtain Kentucky approval for actions within the 100-year floodplain as discussed previously for industrial uses, which would lessen the potential for adverse impacts to the beneficial values of the floodplains.

Wetlands

Recreation and wildlife management uses of the PGDP site could involve minimal development in wetlands. Any proposed construction in a wetland, such as a footbridge or bird blind, would involve permitting and certification requirements with the U.S. Army Corps of Engineers and Kentucky. Construction and operations activities for recreation and wildlife management uses in the undeveloped portion of the site could require additional wetlands studies. If future actions required filling or draining of any wetlands, the responsible party would have to obtain a Section 404 Permit from the Corps of Engineers. The work would be subject to whatever mitigation measures (for example, wetland restoration or replacement) the permit required. To establish definitive boundaries for the wetlands, it is likely the party proposing the work would need to perform a detailed wetlands delineation of the project site. In addition, Kentucky requires a *Clean Water Act* Section 401 Water Quality Certification for actions that involve the placement of dredged or fill materials into wetlands (KDOW 2013). This certification affirms that the action will not violate Kentucky's water quality standards.

3.8 Biological Resources

3.8.1 AFFECTED ENVIRONMENT

The DOE land has a more heavily developed industrial area with undeveloped lands around it that Kentucky uses for wildlife management purposes. The industrial area of the site occupies 1,570 acres consisting of 748 acres inside the security fence and another 822 acres containing the DUF_6 Facility, roads, parking lots, grassy areas, utility infrastructure, water impoundments, and landfills (see

Figure 1-2). The land licensed to the WKWMA covers the rest of the area. The level of development has influenced the vegetation in each area, which varies greatly from the industrialized core of the PGDP site to the outer perimeter of the property.

Within the industrial area, buildings, roads, paved and graveled surfaces, and utility infrastructure (cooling towers, electrical facilities) cover large areas. The vegetation among the buildings consists mainly of maintained grassy areas and fields; shrubs are nearly absent and exist in only a few locations. Immediately surrounding the industrial buildings are several large paved parking areas (about 10 acres total), water impoundments, a water treatment facility, and multiple access and service roads. The vegetation is a mixture of maintained grass fields, areas of second-growth forest, old fields, and wetlands.

The vegetation in the area DOE licenses to Kentucky, with the exception of the DOE-controlled landfill, has a high diversity of interspersed habitats including second-growth hardwood forest, riparian zones along Bayou Creek, palustrine wetlands, old fields, agricultural land, fencerows, and maintained grass fields (CH2M Hill et al. 1992, LATA 2012a). Mixed hardwood forest, grasslands, and wetlands were the historical dominant native vegetation in the region, but agriculture and utility corridors have modified the vegetation by creating open meadows and early successional fields (KDFWR 2013). The Kentucky Department of Fish and Wildlife Resources (KDFWR) manages the WKWMA, including the DOE-licensed land, primarily for early successional wildlife habitat. Common vegetation management practices include periodic mowing, field restoration, prescribed burning, disking, and tree and shrub control (physical removal or herbicide treatment) to maintain open areas and utility corridors. The KDFWR does not currently manage for timber but recognizes that a more active timber management program could become important in the future.

Hardwood forest areas on the PGDP site are dominated by oaks such as the southern red (*Quercus falcata*), post (*Quercus stellata*), pin (*Quercus palustris*), cherrybark (*Quercus pagoda*), swamp chestnut (*Quercus michauxii*), swamp white (*Quercus bicolor*), and hickories such as the shagbark (*Carya ovata*) (CH2M Hill et al. 1992; USACE 1994b; LATA 2012a). Other common species include red maple (*Acer rubrum*), sassafras (*Sassafras albidum*), and sweet gum (*Liquidamber styraciflua*). Common understory trees and shrubs include sassafras, flowering dogwood (*Cornus florida*), sumac (*Rhus copallina*), hawthorn (*Crataegus spp.*), red maple, America elm (*Ulmus americana*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), and sweet gum (DOE 2004). Virginia creeper (*Parthenocissus quinquefolia*) and honeysuckle (*Lonicera japonica*) are common vines. Immature hardwood forest areas are dominated by saplings of oaks and hickories and early to mid-successional trees such as sassafras, black cherry (*Prunus serotina*), red maple, and sumac. The dominant species vary based on local site conditions (upland versus wetland sites) and past disturbance history (USACE 1994b; ANL 2004a). Fencerow communities are dominated by elm (*Ulmus spp.*), locust (*Gleditsia triocanthos*), oak, and maple, with an often-thick understory of sumac, honeysuckle, blackberry (*Rubus allegheniensis*), and grape (*Vitis spp.*) (CH2M Hill et al. 1992; LATA 2012a). Herbaceous growth in these areas includes clover (*Trifolium spp.*), plantain (*Plantago spp.*), and numerous grasses. Mature riparian forest occurs along Little Bayou and Bayou Creeks. These are dominated by river birch (*Betula nigra*), black willow (*Salix nigra*), and cottonwood (*Populus deltoides*), along with other common forest species.

Old-field habitats often are dominated by fescue (*Festuca spp.*), broom-sedge (*Andropogon virginicus*), and other grasses such as eastern gamagrass (*Tripsacum dactyloides*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), and Indian grass (*Sorghstrum nutans*), and a variety of forbs such as species of the *Compositae* family (CH2M Hill et al. 1992; USACE 1994b, 1994c). Unless they are managed through periodic mowing or controlled burning, old-field habitats often have early successional shrub and tree species such as sassafras, black cherry, red maple, hawthorn, flowering dogwood, and sumac.

3.8.1.1 Terrestrial Wildlife

Most of the developed area of the PGDP site hosts few wildlife species because of human activity and the lack of habitat among the buildings. In addition, the security fence around the PGDP minimizes or reduces the potential for many of the medium to larger sized mammal species from entering the area (for example, foxes, coyotes, or larger mammals). However, various species of wildlife do use smaller areas of the forest habitats in the developed area that surrounds the main buildings. Outside the developed area, the Paducah site supports a wide variety of wildlife species because of the diversity of habitats. In general, the diversity of wildlife species increases from the industrial area to the wildlife management area of the site because the amount of development, human activity, and maintained grass decreases while the amount and diversity of native and managed wildlife habitat increases.

Common small mammals include eastern cottontail (*Sylvilagus floridanus*), eastern mole (*Scalopus aquaticus*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus maniculatus*), meadow jumping mouse (*Zapus hudsonius*), southeastern shrew (*Sorex longirostris*), woodland vole (*Microtus pinetorum*), meadow vole (*Microtus pennsylvanicus*), eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*Sciurus niger*), and eastern chipmunk (*Tamias striatus*). Medium-sized mammals that do or are likely to occur on or near the PGDP site include striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and woodchuck (*Marmota monax*). The white-tailed deer (*Odocoileus virginanus*) is the largest mammal and is a major recreational game species in the surrounding wildlife management area. Semiaquatic mammals that occur on the PGDP site or in adjacent areas are the beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and mink (*Mustela vison*) (CH2M Hill et al. 1992). The area hosts a variety of bat species. Mist-netting in the area has captured members of the eastern red bat (*Lasiurus borealis*), little brown myotis (*Myotis lucifugus*), Indiana bat (*Myotis sodalis*), northern long eared myotis (*Myotis septentrionalis*), evening bat (*Nycticeius humeralis*), and eastern pipistrelle (*Pipistrellus subflavus*) species (DOE 2006). Other bat species likely to occur in the vicinity include the hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycterius noctivagans*), and big brown bat (*Eptesicus fuscus*).

The diverse mixture of forest, wetland, grassland, old-field, and transitional habitats on the PGDP site outside of the industrial area supports a variety of bird species. Common game birds include the mourning dove (*Zenaida macroura*), northern bobwhite quail (*Colinus virginianus*), and wild turkey (*Meleagris gallopavo*). The northern bobwhite quail is a major recreational game species in the wildlife management area. Other common species include red-winged blackbird (*Agelaius phoeniceus*), loggerhead shrike (*Lanius ludovicianus*), northern cardinal (*Cardinalis cardinalis*), meadowlark (*Sturnella magna*), red-bellied woodpecker (*Melanerpes carolinus*), Kentucky warbler (*Geothlypis formosa*), red-eyed vireo (*Vireo olivaceus*), eastern towhee (*Pipilo erythrophthalmus*), and common grackle (*Quiscalus quiscula*) (CH2M Hill et al. 1992; DOE 2004; ANL 1991). Predatory birds include great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and red-shouldered hawk (*Buteo lineatus*). Water birds are not common on the PGDP site itself because of the lack of appropriate habitat, but the surrounding area hosts waterfowl such as wood ducks (*Aix sponsa*), geese (*Branta canadensis*), and great blue herons (*Ardea herodias*) (CH2M Hill et al. 1992).

Common reptile and amphibian species near or in wetland habitats include American toad (*Anaxyrus americanus*), Woodhouse's toad (*Anaxyrus woodhousii*), green frog (*Lithobates clamitans*), southern leopard frog (*Lithobates sphenocephalus*), red-eared turtle (*Trachemys scripta*), and snapping turtle (*Chelydra serpentina*) (ANL 1991; DOE 2004). The slimy salamander (*Plethodon sp.*) is a common amphibian in forested areas. The most abundant reptile on the site is the eastern box turtle (*Terrapene carolina*) (ANL 1991). The most abundant snake is the North American racer (*Coluber constrictor*) (ANL 1991).

3.8.1.2 Aquatic Resources

The primary aquatic habitats on the PGDP site (besides the wetlands described in Section 3.7) are Bayou Creek and Little Bayou Creek. There are no natural open-water ponds on the developed portion of the PGDP site, but there are several on the undeveloped lands licensed to the WKWMA that provide habitat for fish, amphibians, and aquatic-dependent reptiles, birds, and mammals.

3.8.1.3 Protected Species

Federally designated species are afforded protection under the *Endangered Species Act of 1973* (16 U.S.C. 1531 et seq.), the *Bald and Golden Eagle Protection Act* (16 U.S.C. 668 et seq.), and the *Migratory Bird Treaty Act* (16 U.S.C. 703 et seq.). These federal laws prohibit activities that could be interpreted as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting protected species. Kentucky does not have an official list of threatened or endangered species but maintains lists of plant and animal species it considers threatened, endangered, or sensitive within Kentucky through their Natural Heritage Program in addition to those with federal protection under the *Endangered Species Act of 1973* (KSNPC 2012). The Kentucky listing does not, however, include prohibitions against activities that could be harmful.

In 2013, DOE communicated with the Service concerning the future possibility of transferring PGDP lands. The correspondence can be found in Appendix B. The Service provided a list of threatened and endangered species that could be present in the vicinity of the PGDP. The Service also expressed concerns about potential removal of Indiana bat maternity roosting and foraging habitat.

No federally listed species has been documented in the vicinity of the Paducah site (USACE 1994c; ANL 2004b; DOE 2004, CH2M Hill et al. 1992). The Indiana bat is a migratory species that depends on large caves and some abandoned mines, principally in areas of limestone karst, for winter hibernacula. The largest winter hibernation populations occur in Indiana, Kentucky, and Missouri; these populations make up nearly 75 percent of all Indiana bats (Pruitt and TeWinkel 2007). No winter hibernacula occur in the vicinity of the Paducah site (USACE 1994c; Pruitt and TeWinkel 2007).

In the spring, Indiana bats migrate to summer forest habitat. Most reproductive females occupy roost sites under the exfoliating bark of dead trees that retain large, thick slabs of peeling bark, although some roost in live trees with loose bark, such as shagbark hickory (USACE 1994c; ANL 2004b; Pruitt and TeWinkel 2007). However, a suitable roost tree could be any tree (live or dead) with a diameter of about 5 inches or more that has exfoliating bark, crevices, or cracks. The bats often return to the same roosting areas each year. Primary roosts usually receive direct sunlight for more than half the day. Roost trees are typically in canopy gaps in a forest, in a fence line, or along a wooded edge; the bats normally select trees larger than 16 inches in diameter (Pruitt and TeWinkel 2007). Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities. Indiana bats typically forage in semi-open to closed (open understory) forested habitats, forest edges, and riparian areas.

The Indiana bat is known to occur near the confluence of Bayou Creek and the Ohio River about 3 miles north of the PGDP site (USACE 1994c; DOE 2004). A 1994 study of the site indicated that potential roosting habitat for this species occurs outside the heavily developed industrial area of the site and in adjacent wooded areas of the WKWMA (USACE 1994c). The study identified potential poor, fair, and good roosting habitats in the outer perimeter of the PGDP site on the lands DOE leases to Kentucky. The best and largest area of potential habitat is in the northeastern corner of the site.

The species Kentucky considers as threatened, endangered, or sensitive that occur near the PGDP site include the Indiana bat (endangered), evening bat, Southeastern myotis (*Myotis austroriparius*; endangered), Bell's vireo (*Vireo bellii*; special concern), Northern crawfish frog (*Rana areolata circulosa*; special concern), lake chubsucker (*Erimyzon sucetta*; threatened), and cream wild indigo plant (*Baptisia bracteata var. glabrescens*; special concern) (KSNPC 2012, DOE 2004). The pale or cream wild indigo plant is known to occur in several locations on the site (USACE 1994c; DOE 2004). The Kentucky list includes the Northern crawfish frog on its list of Species of Greatest Conservation Need (KDFWR 2013). The Northern crawfish frog is a species that is in apparent decline, particularly in surrounding states. The WKWMA has a relatively secure population of the species and is the only tract of Commonwealth-managed land in Kentucky that has Northern crawfish frogs (Kreher 2013). Recent surveys (March 16, 2013) based on breeding vocalizations or choruses identified at least 22 locations and possibly several other potential sites where there are populations of Northern crawfish frogs on the lands DOE licenses to Kentucky (Kreher 2013) and on the adjacent Kentucky-owned wildlife management lands.

Many of the bird species on the PGDP site, whether yearlong residents or summer or winter migrants, are protected by the *Migratory Bird Treaty Act* that prohibits any action, including destruction of nests, which would harass, harm, wound, or kill the protected species. Any trapping, capturing, or collecting of protected species is prohibited.

The *Bald and Golden Eagle Protection Act* prohibits the taking, possession, sale, purchase, barter, offer to sell, transport, export or import, of any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*), alive or dead, including any part, nest, or egg, unless allowed by permit. Western Kentucky has well-established bald eagle populations, including nesting pairs and winter migrants (KDFWR 2012). However, no nesting pairs occur in McCracken County, which does not contain quality summer or winter eagle habitat. Because both summer nesting pairs and populations of winter migrants occur in surrounding counties, it is possible that individual bald eagles could be occasionally observed in the vicinity of the PGDP site. Golden eagles do not nest in Kentucky, but they do migrate through and winter in the area and could occasionally be observed in the vicinity of the Paducah site.

Habitat for protected mussel species does not occur on the PGDP site. However, the site does contain streams that flow into the Ohio River, some of which is habitat for protected mussel species. DOE uses best management practices to control soil erosion and sedimentation and effluent controls to minimize impacts to water quality.

3.8.2 ENVIRONMENTAL CONSEQUENCES

3.8.2.1 Industrial Use

Construction. In the existing industrial area of the PGDP site, impacts to vegetation and terrestrial wildlife resources from industrial redevelopment and the disturbance of 25 acres of land as a result of the conceptual project would be relatively minor because the vegetation in this area has been highly modified. However, some areas of wildlife habitat do exist around the outer edge of the industrialized area, including open fields, successional forests, and small tracts of hardwood forests. Depending on where industrial redevelopment occurred, land clearing and construction could disturb some areas of wildlife habitat. Because of the small amount of suitable habitat, protected species are unlikely to occur (for example, threatened and endangered species or eagles) or likely would occur in minimal numbers in this more highly developed area. Therefore, redevelopment in this area would be likely to have only minimal impacts on protected species such as migratory birds. Some short-term minor impacts to aquatic resources could occur during redevelopment construction from potential stormwater runoff that collects into either Little Bayou Creek or Bayou Creek. However, users of the real property would have to

eliminate or mitigate those impacts through implementation of erosion control and stormwater management practices that Kentucky would require as part of the permitting process for industrial development and activities.

In the undeveloped area, industrial development and the potential disturbance of 25 acres of land could have impacts on biological resources depending on the location of the facilities. This area contains mixed hardwood forest areas, particularly on the west and south sides, and riparian forests along Bayou Creek on the west side with a mixture of different habitat types that range from maintained grass fields to forests on the wildlife management area lands. Development in these areas for industrial use could result in the loss of early to mid-successional habitats and forest habitat and likely loss of individuals of the wildlife species that use those areas. The affected wildlife species would vary depending on the location and size of the development and the types of disturbed habitats. Impacts would include direct loss of habitat and wildlife from land clearing and construction. In addition, some wildlife species would avoid the vicinity of constructed facilities because of human activity and disturbance, which would cause some additional indirect loss of habitat. Numerous electrical transmission lines and easement rights-of-way cross the wildlife management area of the PGDP site. The Kentucky Department of Fish and Wildlife actively manages these areas for early and mid-successional wildlife habitat.

Populations of the northern crawfish frog occur in the wildlife management area, and development could cause habitat loss from physical disturbance or alteration of the hydrology (Kreher 2013). Although Indiana bats have not been observed in forested areas on the PGDP site, the U.S. Army Corps of Engineers identified some areas as poor, fair, and good Indiana bat habitat based on the presence of suitable maternal roost trees, canopy cover of trees, distance from roads, and distance to potential foraging areas along waterways (USACE 1994c). These areas are contiguous with similar but higher potential bat habitat on the adjacent Kentucky-owned lands. The best potential Indiana bat habitat occurs in the northeast corner and along the west side of the PGDP site (USACE 1994c). If industrial development occurred in the undeveloped area of the PGDP site, further assessment of potential impacts to the Indiana bat could be necessary depending on the location of the development and type of habitat it would disturb. Summer roosting habitat such as large dead or live trees with exfoliating bark, and suitable adjacent foraging areas are of primary concern. Future threatened and endangered species assessments and consultations would be the responsibility of the development organization. Transfers to other federal agencies could involve consultations under Section 7 of the *Endangered Species Act of 1973*. Transfers to nonfederal entities could require consultation under Section 10 of the Endangered Species Act. The Service is currently revising range-wide summer survey guidelines for the Indiana bat (78 FR 1879, 78 FR 9409). The survey effort necessary to evaluate the potential presence of Indiana bats for future development activity could depend on the final guidance and could require more than 1 year of surveys.

Potential impacts to the aquatic resources in Bayou Creek could occur from stormwater runoff during construction and possibly after construction from increased runoff from facilities. However, as noted above, users of the real property would have to eliminate or mitigate those impacts through implementation of erosion control and stormwater management practices that Kentucky would require.

Operations. Because construction would remove vegetation and cause wildlife to relocate, operation of the conceptual project or other industrial facilities on transferred land would pose very little additional impact beyond construction-related activities on biological resources. Future uses would be consistent with existing county zoning ordinances and development guidelines and would not impact flora and fauna or any of the federally or Commonwealth-listed threatened and endangered species.

3.8.2.2 Recreation and Wildlife Management Uses

Although less suitable as a redevelopment option in the existing developed area of the PGDP site, recreational or wildlife management uses in the already developed areas of the site would have minimal impact, and could have a beneficial impact by increasing the quality of biological resources, depending on the type of redevelopment activity (for example, sports fields, bike or equestrian trails, or wildlife habitat). Potential impacts to biological resources in the undeveloped area would depend on where specific types of recreational and wildlife management activities would occur in relation to existing wildlife habitat. Because DOE currently licenses much of the undeveloped area of the site to Kentucky for wildlife management and related outdoor recreation (for example, hunting, fishing, birding, and bird dog trials), no impact to biological resources would occur from continuing these uses of the area. Most of this area is currently managed for early successional wildlife habitat, including areas underneath existing electrical transmission lines. However, additional human recreational uses such as hiking, biking, all-terrain vehicles, or equestrian trails could result in impacts to some species of wildlife through human disturbance, depending on where these developments occurred and the season of use.

3.9 Socioeconomics and Environmental Justice

3.9.1 AFFECTED ENVIRONMENT

3.9.1.1 Socioeconomics

Socioeconomics is the study of the interrelation between social and economic factors. For analysis under the *National Environmental Policy Act of 1969*, these factors include employment and income, demographics, availability of housing and community services, and community fiscal status. Data sources include the U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, U.S. Census Bureau, and the National Center for Education Statistics. Different data sources might provide different numbers in terms of employment, income, and population

The region of influence for the purpose of this analysis includes Ballard, Carlisle, Graves, Marshall, and McCracken Counties in Kentucky and Massac County in Illinois. The region of influence reflects where current PGDP workers live and includes the area in which these workers spend much of their wages.

Employment and Income

Table 3-8 shows that employment by sector changed slightly from 2000 to 2010 (the most recent year for which data are available). The educational, health, and social services industry employs the most people, about 21 percent of total employment in the region, followed by retail trade, manufacturing, and arts, entertainment, recreation, accommodation and food services, with 12.4 percent, 12.1 percent, and 10.1 percent, respectively.

The region of influence experienced negative growth over the last 10 years (Table 3-9). The labor force decreased slightly from 75,548 in 2000 to 74,885 in 2010, for a decrease of less than 1 percent for the period. Employment declines outpaced the labor force decline, decreasing from 71,443 in 2000 to 69,046 in 2010, for a decline of 3 percent for the period. The region of influence unemployment rate, which was 5.4 percent in 2000, was 7.8 percent in 2010 (Table 3-9). The average unemployment rate for Kentucky was 8.2 percent in 2010, up from 5.7 percent in 2000 (USCB 2015a, 2015b). This shows that the region of influence has experienced a marginally smaller than average economic decline over the past decade in comparison with other areas in Kentucky.

Table 3-8. Employment by sector (number of jobs) (USCB 2015a, 2015b).[a]

Industry sector	2001							2010						
	Ballard	**Carlisle**	**Graves**	**Marshall**	**McCracken**	**Massac**	***Total ROI*[a]**	**Ballard**	**Carlisle**	**Graves**	**Marshall**	**McCracken**	**Massac**	***Total ROI*[a]**
Forestry, fishing, and related activities	142	150	795	278	337	260	*1,962*	228	171	851	215	507	118	*2,090*
Mining	455	207	1,148	1,161	2,167	428	*5,566*	313	255	1,139	1,132	2,064	383	*5,286*
Utilities	706	471	3,510	2,559	3,786	783	*11,815*	413	349	2,320	1,698	2,933	618	*8,331*
Construction	129	76	647	472	1,449	254	*3,027*	132	38	603	514	1,054	120	*2,461*
Manufacturing	489	309	1,963	1,648	4,286	881	*9,576*	483	188	2,035	1,488	3,617	760	*8,571*
Wholesale trade	211	194	862	1,022	1,999	646	*4,934*	192	140	745	1,015	2,280	784	*5,156*
Retail trade	153	36	266	257	788	93	*1,593*	58	0	204	246	658	59	*1,225*
Transportation and warehousing	117	72	596	619	1,215	233	*2,852*	136	166	635	583	1,167	249	*2,936*
Information	231	53	598	583	1,756	290	*3,511*	260	52	830	938	2,298	446	*4,824*
Finance and insurance	639	398	3,237	2,295	6,053	1,424	*14,046*	680	322	3,348	3,180	5,839	1,385	*14,754*
Real estate and rental and leasing	161	122	853	1,163	2,921	810	*6,030*	235	89	1,032	1,698	3,035	889	*6,978*
Professional, scientific, and technical services	271	86	946	816	1,540	333	*3,992*	149	138	946	896	1,740	301	*4,170*
Management of companies and enterprises	144	47	490	501	1,062	295	*2,539*	156	70	383	394	889	372	*2,264*
Administrative and waste management services	142	150	795	278	337	260	*1,962*	228	171	851	215	507	118	*2,090*
Educational services	455	207	1,148	1,161	2,167	428	*5,566*	313	255	1,139	1,132	2,064	383	*5,286*
Health care and social assistance	706	471	3,510	2,559	3,786	783	*11,815*	413	349	2,320	1,698	2,933	618	*8,331*
Arts, entertainment, and recreation	129	76	647	472	1,449	254	*3,027*	132	38	603	514	1,054	120	*2,461*
Accommodation and food services	489	309	1,963	1,648	4,286	881	*9,576*	483	188	2,035	1,488	3,617	760	*8,571*
Other services, except public administration	211	194	862	1,022	1,999	646	*4,934*	192	140	745	1,015	2,280	784	*5,156*
Government and government enterprises	153	36	266	257	788	93	*1,593*	58	0	204	246	658	59	*1,225*
Total employment	**3,848**	**2,221**	**15,911**	**13,374**	**29,359**	**6,730**	***71,443***	**3,435**	**1,978**	**15,071**	**13,997**	**28,081**	**6,484**	***69,046***

a. ROI = region of influence.

Table 3-9. Economic characteristics (USCB 2015a, 2015b; BEA 2013).

County/characteristic	2000	2010	Percent change
Ballard County, Kentucky			
Per capita income ($)	$25,544	$33,968	33.0%
Labor Force	4,015	3,740	-6.8%
Employment	3,848	3,435	-10.7%
Unemployment	167	305	82.6%
Carlisle County, Kentucky			
Per capita income ($)	$22,545	$28,803	27.8%
Labor Force	2,369	2,239	-5.5%
Employment	2,221	1,978	-10.9%
Unemployment	148	261	76.4%
Graves County, Kentucky			
Per capita income ($)	$22,202	$28,287	27.4%
Labor Force	16,838	16,645	-1.1%
Employment	15,911	15,071	-5.3%
Unemployment	927	1,574	69.8%
Marshall County, Kentucky			
Per capita income ($)	$24,909	$31,253	25.5%
Labor Force	13,955	14,974	7.3%
Employment	13,374	13,997	4.7%
Unemployment	581	977	68.2%
McCracken County, Kentucky			
Per capita income ($)	$28,380	$38,042	34.0%
Labor Force	31,222	30,381	-2.7%
Employment	29,359	28,081	-4.4%
Unemployment	1,863	2,300	23.5%
Massac County, Illinois			
Per capita income ($)	$21,373	$30,161	41.1%
Labor Force	7,149	6,906	-3.4%
Employment	6,730	6,484	-3.7%
Unemployment	419	422	0.7%
Total/overall region of influence			
Per capita income ($)	**$25,318**	**$33,263**	**31.4%**
Labor Force	**75,548**	**74,885**	**-0.9%**
Employment	**71,443**	**69,046**	**-3.4%**
Unemployment	**4,105**	**5,839**	**42.2%**

The region of influence per capita income was $33,263 in 2010. This is 2 percent higher than Kentucky's per capita income of $32,504 but 26 percent lower than Illinois' per capita income of $42,025 in the same year. As the data in Table 3-9 shows, the population inside the region of influence, as well as inside the six counties making up the region, has lower per capita income than that of the United States. In 2001, the region of influence per capita income was $25,318 or 81 percent of the national per capita income of $31,157. In 2010, the region of influence per capita income increased to $33,263, which is 84 percent of the national per capita income of $39,791. During the same period, the per capita income in Kentucky followed a similar trend as that of the region of influence.

Site Employment

As of January 2013, DOE and USEC employed 1,761 workers at the PGDP site, which was about 6 percent of total employment in McCracken County (Blankenship 2012). Sitewide employment declined because the uranium enrichment operations ceased.

Population

McCracken County is primarily rural, as are the other counties in the region of influence. Over the last 10 years, population in the region of influence has grown at a slower rate in comparison to Kentucky-wide population growth. The U.S. Census Bureau projects the population in the region of influence to grow at a higher rate than Kentucky during the current decade, increasing 2.4 percent between 2010 and 2020. Table 3-10 lists historical and projected population in the region of influence and Kentucky.

Table 3-10. Historic and projected populations (USCB 2013a, 2013b).

County	2000	2010	2020	2030
Ballard County, Kentucky	8,286	8,249	8,217	8,073
Carlisle County, Kentucky	5,351	5,104	4,947	4,721
Graves County, Kentucky	37,028	37,121	37,630	37,560
Marshall County, Kentucky	30,125	31,448	33,023	33,787
McCracken County, Kentucky	65,514	65,565	66,621	66,567
Massac County, Illinois	15,161	15,429	17,820	18,649
Total region of influence	**161,465**	**162,916**	**168,258**	**169,357**
Kentucky	4,041,769	4,339,367	4,672,754	4,951,178

The population in the region of influence in 2010 was 162,916 (USCB 2013a). In 2010, 40 percent of the population of the region of influence resided in McCracken County. Between 2000 and 2010, with the exception of Ballard and Carlisle Counties, each of the counties in the region of influence experienced a small increase in population.

The City of Paducah, in McCracken County, is the largest population center in the region of influence with an estimated 2010 population of 25,024. Other nearby population centers include Mayfield (10,024) in Graves County, Reidland (4,491) in McCracken County, and Benton (4,349) in Marshall County. Smaller population centers in the region of influence include Calvert City (2,566) in Marshall County, Ledbetter (1,683) in Livingston County, and LaCenter (1,009) in Ballard County (USCB 2013a).

Housing

Table 3-11 lists housing characteristics for the region of influence, including owner- and renter-occupied homes, along with median home values for each county in the region of influence. McCracken County accounts for 40 percent of the housing units in the region as well as the highest number of vacant units (USCB 2013a). The median home value ranges from $67,400 in Carlisle County to $107,500 in McCracken County (USCB 2013c).

Community Services

The community services in the region of influence include public schools, law enforcement, fire suppression, medical services, and recreation resources.

- Public schools. Table 3-12 lists education statistics in the region of influence, which has nine school districts with a total of 68 schools serving a student population of 25,976 during the 2010–2011 and 2011–2012 school years (NCES 2013). The student-to-teacher ratio in the region of influence was 16 to 1.

Table 3-11. Housing characteristics, 2010 (USCB 2013a, 2013c).

County	Total housing units	Occupied housing units	Owner-occupied units	Renter-occupied units	Vacant units	Owner vacancy rate	Rental vacancy rate	Median home value
Ballard	3,885	3,397	2,670	727	488	1.5%	7.8%	$78,100
Carlisle	2,441	2,116	1,730	386	325	1.9%	11.2%	$67,400
Graves	16,777	14,978	11,055	3,923	1,799	1.9%	9.1%	$83,900
Marshall	15,748	13,073	10,506	2,567	2,675	2.2%	11.5%	$96,900
McCracken	31,079	28,227	18,762	9,465	2,852	2.5%	8.1%	$107,500
Massac	7,113	6,362	4,763	1,599	751	2.7%	7.3%	$81,800
Total/over-all region of influence	**77,043**	**68,153**	**49,486**	**18,667**	**8,890**	**1.9%**	**9.7%**	**$82,850**

Table 3-12. Public education statistics (NCES 2013).[a]

County	Number of school districts	Number of schools	Student enrollment	Number of teachers	Student: teacher ratio
Ballard County, Kentucky	1	4	1,460	79	18:1
Carlisle County, Kentucky	1	3	836	61	14:1
Graves County, Kentucky	2	18	6,303	377	17:1
Marshall County, Kentucky	1	12	4,857	318	15:1
McCracken County, Kentucky	2	22	9,905	584	17:1
Massac County, Illinois	2	9	2,615	167	16:1
Total/overall region of influence	9	68	25,976	1,586	16:1

a. 2010–2011 and 2011–2012 school years.

- Law enforcement. Several Kentucky, county, and local law enforcement agencies serve the region of influence. There are 114 law enforcement employees in the region of influence. McCracken County has 44 law enforcement employees in the McCracken County Sheriff's Office and the Paducah Police Department (FBI 2013).

- Fire suppression. According to the U.S. Fire Administration's National Fire Department Census Database, there are 70 fire stations and a total of 1,114 career, volunteer, and paid firefighters that serve the region of influence (USFA 2013). McCracken County has 18 fire stations with 271 career and volunteer firefighters.

- Medical services. McCracken County is served by two primary hospitals providing tertiary and short-term acute care. Both are located in Paducah. Western Baptist Hospital has 349 beds and approximately 800 full-time equivalent health care providers and staff. Lourdes Hospital is Catholic affiliated and has 359 beds and approximately 1,300 full-time equivalent health care providers and staff. Paducah also has one behavioral care facility, two transitional care facilities, and two nursing homes. Collectively, these facilities have 479 beds and about 500 full-time equivalent health care providers and staff (http://www.hospital-data.com/hospitals). Other hospitals in the region include Jackson Purchase Medical Center in Graves County, Marshall County Hospital, and Massac Memorial Hospital in Massac County.

- Recreation. The undeveloped area includes the 1,986 acres DOE licenses to Kentucky. Major recreational activities include camping, hunting deer and small game, field trials for dogs and horses, trail riding, fishing, and skeet and target shooting (Ethridge 2013). The WKWMA hosts

15 to 20 horseback bird dog field trials annually (Green 2013). An estimated 10,000 people use the WKWMA each year (PRS 2009).

Fiscal Characteristics

Each of the counties in the region of influence assesses a 6-percent sales tax on the purchase or lease price of taxable goods and on utility services. There are no local sales taxes in Kentucky. The Kentucky Constitution requires taxation of all classes of taxable property, and its statutes allow local jurisdictions to tax only a few classes. All locally taxed property is subject to county taxes and school district taxes. Property inside city limits may also be subject to city property taxes (KCED 2013).

3.9.1.2 Environmental Justice

On February 11, 1994, the President of the United States issued Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority and Low-Income Populations." The purpose of the Executive Order is to focus the attention of federal agencies on human health and environmental conditions in minority and low-income communities. Environmental justice analyses identify disproportionate placement of high and adverse environmental or health impacts from proposed federal actions on minority or low-income populations and identify alternatives that could mitigate such impacts. DOE used data from the U.S. Census Bureau's American Community Survey for this analysis. The Census identifies minority populations as Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; other race; of two or more races; and Hispanic or Latino. This EA uses poverty status to define low-income communities. The 2010 Census defines the poverty level in the United States as $11,369 annual income or less for an individual, and $22,541 annual income or less for a family of four (USCB 2012).

This analysis follows the guidance in the CEQ *Environmental Justice Guidance under the National Environmental Policy Act of 1969* (CEQ 1997a). The study area for environmental justice encompasses the area the federal action would be most likely to affect and considers the area where potential impacts could occur. The region of influence for this analysis is the census tracts in the six-county region of influence (Ballard, Carlisle, Graves, Marshall, and McCracken Counties in Kentucky and Massac County in Illinois). Following CEQ guidance, the analysis identified minority census tracts as minority populations if the minority population of the tract exceeded 50 percent. The guidance does not specify a threshold for identifying low-income communities; the analysis identified census tracts with a poverty level percentage higher than that of Kentucky as a whole. In Kentucky, 17.7 percent of the individuals were below the poverty level in 2010.

The analysis used estimates from the U.S. Census Bureau's American Community Survey to identify minority and low-income populations for the census tracts within the six-county region of influence. Table 3-13 lists minority and income data for the region of influence; gray shading identifies those the analysis determined are low-income and minority populations. There are 41 census tracts in the six-county region of influence. There are eight census tracts immediately surrounding the PGDP site (313, 314, 315, 316, 9501, 9701, 9702, and 9704). The site is in tract 315.

Areas with minority populations that exceed 50 percent were considered minority areas. Based on the Census Bureau data, two census tracts have minority populations over 50 percent. However, both of the boundaries for these tracts are over 10 miles from PGDP.

Table 3-13. Minority and low-income populations, 2009 (estimated) (USCB 2013d, 2013e). The PGDP is in Census Tract 315.

Census tract, county	Percent minority	Percent individual below poverty level
9701, Massac County, Illinois	6.1%	12.4%
9702, Massac County, Illinois	12.8%	10.50%
9703, Massac County, Illinois	10.1%	11.0%
9704, Massac County, Illinois	7.7%	25.7%
9501, Ballard County, Kentucky	5.4%	13.7%
9502, Ballard County, Kentucky	9.9%	15.4%
9503, Ballard County, Kentucky	5.7%	10.6%
9601, Carlisle County, Kentucky	0.7%	6.7%
9602, Carlisle County, Kentucky	3.2%	24.1%
9603, Carlisle County, Kentucky	0.8%	15.8%
201, Graves County, Kentucky	20.8%	33.3%
202, Graves County, Kentucky	30.3%	22.0%
203, Graves County, Kentucky	20.9%	27.6%
204, Graves County, Kentucky	2.1%	11.8%
205, Graves County, Kentucky	3.3%	18.0%
206, Graves County, Kentucky	3.2%	19.0%
207, Graves County, Kentucky	3.9%	12.8%
208, Graves County, Kentucky	4.5%	19.9%
209, Graves County, Kentucky	0.0%	4.1%
301, McCracken County, Kentucky	14.2%	45.6%
302, McCracken County, Kentucky	36.1%	42.2%
303, McCracken County, Kentucky	19.9%	52.3%
304, McCracken County, Kentucky	62.6%	45.8%
305, McCracken County, Kentucky	58.0%	18.5%
306, McCracken County, Kentucky	31.3%	38.1%
307, McCracken County, Kentucky	32.3%	17.3%
308, McCracken County, Kentucky	9.1%	10.6%
309, McCracken County, Kentucky	23.3%	20.4%
310, McCracken County, Kentucky	3.7%	12.9%
311, McCracken County, Kentucky	2.3%	3.2%
312, McCracken County, Kentucky	3.4%	7.1%
313.01, McCracken County, Kentucky	9.2%	13.5%
313.02, McCracken County, Kentucky	Not available	3.0%
314, McCracken County, Kentucky	5.8%	10.5%
315, McCracken County, Kentucky	3.6%	11.1%
316, McCracken County, Kentucky	6.4%	6.3%
9501, Marshall County, Kentucky	2.4%	8.2%
9502, Marshall County, Kentucky	2.2%	8.8%
9503, Marshall County, Kentucky	4.1%	16.5%
9504, Marshall County, Kentucky	3.3%	10.2%
9505, Marshall County, Kentucky	3.6%	12.1%
9506, Marshall County, Kentucky	3.1%	13.9%

3.9.2 ENVIRONMENTAL CONSEQUENCES

3.9.2.1 Industrial Use

To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1).

3.9.2.1.1 Socioeconomics

Construction. In terms of employment and income, DOE assumed 120 construction workers would be needed per year. For that year of nonresidential construction, each worker would earn about $52,966, for a total increase in income from direct jobs of about $6.3 million. Estimated direct construction jobs result in about 0.865 indirect job each. Therefore, the conceptual project would generate an additional 104 temporary jobs earning an additional $4.6 million at the regional average labor rate of $44,248 per year. Therefore, construction activities would result in a total of 224 direct and indirect jobs earning an additional $10.9 million. This number of jobs would not result in a change in population, and therefore it would not be likely to affect housing availability or community services or have long-term fiscal impacts in the region. Therefore, the socioeconomic impacts would be short-term and beneficial.

Operations. In terms of employment and income, the number of employees at a new business at the PGDP would probably not exceed the current PGDP workforce. Future operations would have a positive impact on regional socioeconomics. Development could create up to 1,000 long-term jobs during operations, an increase of up to 1.5 percent from the 2010 total employment in the region of influence (Table 3-8). The indirect impact, such as the creation of indirect jobs, would depend to a large extent on the specific industry and the extent to which the region of influence could supply the goods and services those industries would use. Changes in regional income would depend on the amount of wages but would likely be proportional to the number of new direct jobs. In terms of other operational impacts:

- Population. Based on the estimated number of new direct jobs and the assumption that workers in the existing labor force in the region of influence would fill all direct and indirect jobs force, impacts to population would be unlikely.

- Housing. Based on the estimated number of jobs and the assumption that workers in the existing labor force in the region of influence would fill all direct and indirect jobs, there would be no need for additional housing. However, if there was need for temporary housing, the current housing market would be able to meet that need. Therefore, there would be no impact to housing, including sales, foreclosures, and price stability.

- Community Services. Based on the number of estimated jobs created and the assumption that all direct and indirect jobs would be filled by workers from the region of influence's existing labor force, no impact to public schools, law enforcement, or firefighting capabilities is anticipated. Impacts to recreation resources could occur if development removed or altered the use of the WKWMA portion of the site. Impacts could include a loss of recreation opportunities and revenue.

- Fiscal Impacts. Beneficial impacts include increased local revenue from real estate, commercial activities, or sales taxes if the land is sold to private, taxable corporations. The actual size of the impact is unknown at this time. However, it should result in only limited changes in regional employment and income. McCracken County could generate additional revenue (that is, from property and payroll taxes) from the transfer of the property and from the improvement of the

property. The region of influence would benefit from additional jobs if any. Kentucky and McCracken County would receive additional revenue through income and sales taxes.

3.9.2.1.2 Environmental Justice

Although current assumptions suggest there would be no high and adverse human health or environmental impacts, the actual circumstances would depend on specific choices made at the time of development. Specific proposed uses of the site might require additional supplemental documentation, which would include a review of environmental justice issues. Environmental impacts from most projects tend to be highly concentrated within the project site boundaries and tend to decrease as distance from the site increases. There are two census tracts within the region of influence in which the minority population exceeds the 50-percent threshold (Table 3-13). Census tracts 304 and 305 in McCracken County are about 10 miles east of the PGDP. Several of the census tracts in the region of influence meet the definition of low-income populations. There are several such populations in Massac and Carlisle Counties and a concentration of populations in McCracken and Grave Counties. During construction and operations of the conceptual project or other comparable industrial facility, it is anticipated that environmental, health, and occupational safety impacts would be minimal, temporary, and confined to the PGDP site. Therefore, there would not be disproportionately high and adverse human health effects or environmental impacts to minority or low-income populations.

3.9.2.2 Recreation and Wildlife Management Uses

3.9.2.2.1 Socioeconomics

It is anticipated that construction or operation impacts from recreation and wildlife management uses would be less than those from industrial uses because of the small number of jobs necessary to support recreation and wildlife management uses. Construction of facilities, if any, under this use would likely be less than under either of the other uses. Any socioeconomic impacts from construction-related activities would be short in duration. The number of employees that would occupy any new business as represented by the conceptual project at the PGDP site would not be expected to exceed the historical workforce. Future operations would have a small positive impact on regional socioeconomics.

3.9.2.2.2 Environmental Justice

Impacts to environmental justice populations from recreation and wildlife management use would be similar to those described for industrial use. During construction and operations, it is anticipated that environmental, health, and occupational safety impacts would be minimal, temporary, and confined to the PGDP site. Therefore, there would not be disproportionately high and adverse human health effects or environmental impacts to minority or low-income populations.

3.10 Cultural Resources

3.10.1 AFFECTED ENVIRONMENT

The *National Register of Historic Places* identifies cultural resources as locations having significance in American history, architecture, archaeology, engineering, and culture that is present in districts, sites, buildings, structures, and objects that are associated with significant events the lives of significant persons, embody distinctive characteristics, or that have yielded or may yield information important in history or prehistory (36 CFR Part 800).

Before Euro-American settlement, much of the land in western Kentucky was part of the Chickasaw Nation. In 1818, Andrew Jackson and Isaac Shelby negotiated a treaty with the Chickasaw Nation to purchase this land. The PGDP site was the site of several large farms in the nineteenth century, primarily those of the Baldry, Owen, and Carneal families (BJC 2006).

In 1942, the federal government purchased a portion of the Baldry farm for construction of the Kentucky Ordnance Works. The Works was an explosives manufacturing facility that produced trinitrotoluene (TNT) and concentrated sulfuric acid during World War II. Today, the former Works site consists largely of concrete foundations of the trinitrotoluene and acid production areas.

During the Cold War, President Harry Truman decided to increase research and development of a hydrogen bomb. In the fall of 1950, the U.S. Atomic Energy Commission embarked on a huge expansion program to meet these requirements and began construction of nuclear facilities across the country to meet this mission. These initiatives included two gaseous diffusion plants, one in Portsmouth, Ohio, and the other in Paducah, Kentucky. The PGDP produced low-enriched uranium for further processing by the Portsmouth plant. In the late Twentieth Century, the plants' mission shifted to the production of low-enriched uranium for use as fuel in nuclear power plants.

Construction at the PGDP began in early January 1951 with the demolition of Works buildings and the repair of the abandoned railroad line. At the same time, TVA began acquiring property to the north of the PGDP site for the construction of the electricity-generating Shawnee Fossil Plant. Already owning the 4,000-acre Works site, the U.S. Atomic Energy Commission purchased an additional 3,335 acres for the construction of the gaseous diffusion plant. Most of the property was purchased by the federal government from February to May 1951 (BJC 2006).

The U.S. Army Corps of Engineers conducted a cultural resource investigation in 1994 that found 34 archeological sites in the surveyed areas outside the security fences; the report noted an additional six sites that earlier surveys had identified, but the 1994 survey did not reexamine them (USACE 1994d).

DOE completed an intensive cultural resources survey of architectural properties at the PGDP site in 2006. It provided information about the DOE buildings and sites eligible for listing on the National Register and identified as Register-eligible contributing properties to the PGDP Historic District. The survey identified 101 contributing properties for a Register-eligible historic district at the facility. These sites are all within the developed area inside the security fence. The historic district would be eligible under Criterion A, association with historic events or activities, for its military significance during the Cold War and its role in the development of commercial nuclear power. This survey did not include the archaeological components normally included in such surveys because much of the PGDP area has been heavily disturbed (BJC 2006).

Kentucky Individual Historic Resource Inventory Forms were completed for each contributing building in the Register-eligible PGDP Historic District as part of the cultural resource survey. Each property was inventoried in accordance with Kentucky Historic Preservation Office standards and documented photographically. These inventory forms would constitute a part of the mitigation of any related proposed actions.

The National Register lists 26 historic sites in McCracken County, including commercial districts, churches, memorials, houses of important persons, including former Vice President Alben Barkley, and several sites that relate to African-American history and culture. The National Park Service, which manages the National Register, is considering three additional sites for listing. All of these sites are in the City of Paducah about 10 miles from the PGDP. Since DOE issued the 2006 Cultural Resources

Management Plan, it has demolished or begun demolition of three of the Register-eligible structures as part of the ongoing environmental management activities at PGDP.

DOE licenses 1,986 acres of its real property at the site to the Kentucky Department of Fish and Wildlife as part of the WKWMA, which surrounds much of the plant. This undeveloped area could contain undiscovered archaeological locations and potential cultural resources.

3.10.2 ENVIRONMENTAL CONSEQUENCES

The Advisory Council on Historic Preservation regulations require that projects undertaken, funded, licensed, or permitted by federal agencies be reviewed to determine if they could affect properties that are listed in the National Register or are eligible for listing in the National Register.

The area of potential effect for the proposed undertaking of conveyance of real property is the PGDP site. Future uses of the site would not affect the listed or eligible sites in the City of Paducah because they are all over 10 miles from the PGDP site.

While DOE does not expect cultural impacts, there is a potential for impacts that could occur either indirectly or directly depending on future development activities and locations. For DOE activities, the Department will comply with the provisions of its *Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky* (BJC 2006).

3.10.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1). DOE has determined, in accordance with Advisory Council on Historic Preservation regulations (30 CFR Part 800), that there is a potential for any future proposed undertakings after transfer to cause effects to eligible historic properties depending on the type of activities and their locations. Those regulations specify that if adverse effects are expected, consultation with the Kentucky SHPO should be initiated to seek ways to avoid, minimize, or mitigate the adverse effects.

DOE has notified the Kentucky Historic Preservation Office, along with American Indian tribes who might have interest in the area of the site, of the potential transfers. DOE held a conference call with the Kentucky SHPO on May 9, 2013 (Groppe 2013). The Department informed the SHPO that it will follow Section 4 of the *Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky* (BJC 2006), which details DOE's Cultural Resource Management Methods for PGDP and that the Department will consult with the SHPO as appropriate under that plan.

In addition, DOE sent letters to 10 American Indian tribes to request their input on the Proposed Action and any cultural resources important to them that might be present. Appendix B contains the list of recipients and an example copy of the letter.

The Cherokee Nation submitted the only response received by DOE (see Appendix B). The tribe indicated it has no records of cultural resources in the area, requested DOE contact the Eastern Band of Cherokee Indians, and requested further consultation if items of cultural significance are discovered. DOE included the Eastern Band of Cherokee Indians in its request for information. If items of cultural significance were discovered while DOE remains responsible for any action at the PGDP site, DOE would further consult with the affected tribes. DOE did not receive responses from the other tribes.

Much of the PGDP site has been disturbed through the construction and operation of federal facilities and the subsequent environmental management actions as well as the earlier farming activities. The environmental management of the PGDP site will include decontamination and decommissioning of the site under CERCLA. Mitigation for any adverse effects to DOE's historic properties as a result of the CERCLA actions will be addressed in accordance with CERCLA. For this EA, it is reasonable to consider that there would not be adverse effects from future real property transfers on DOE-built properties; they will be addressed programmatically under a separate undertaking. While DOE does not expect cultural impacts, there is a potential for impacts that could occur either indirectly or directly depending on future development activities and locations.

Sensitive resources, including cultural and historic resources, would be protected as necessary through the use of deed restrictions and compliance with all applicable local, Kentucky, and federal regulations.

Cultural resource surveys to identify historic properties would have to be undertaken before initiation of any new construction, especially in the undeveloped area of the site. If archaeological resources were encountered or historical or traditional cultural properties were identified, the responsible party would be required to consult with the Kentucky Historic Preservation Office and any potentially affected American Indian tribes.

Operations. Impacts of future operations on cultural resources would be minimal, presuming they would be of the same industrial nature as current DOE activities. Future uses of the site would not affect the listed or eligible sites in the City of Paducah because they are all over 10 miles from the PGDP site.

3.10.2.2 Recreation and Wildlife Management Uses

Using the PGDP site for recreation and wildlife management would likely not involve significant construction, if any. Therefore, this use would present the least potential for impacts to historic properties. Regardless of use, cultural resource surveys to identify historic properties would have to be undertaken before initiation of any new construction. If archaeological resources were encountered or historical or traditional cultural properties were identified, the responsible party would be required to consult with the Kentucky Historic Preservation Office and any potentially affected American Indian tribes.

3.11 Infrastructure and Transportation

3.11.1 AFFECTED ENVIRONMENT

Transportation

The PGDP is within a well-established transportation network. This includes Interstate Highway 24 (I-24) several U.S., Kentucky, and local highways, the Paducah and Louisville Railway, and the Barkley and Metropolis Municipal airports. Because McCracken County is predominantly a residential, commercial, industrial, and medical services area, its traffic is heavily influenced by peak travel patterns of commuting workers.

Traffic on (I-24 ranges from 26,400 to 35,500 cars a day (Jordan, Jones, & Goulding 2002). In addition to I-24, U.S. Highways 60 and 45 (US 60 and US 45) presently carry more than 25,000 vehicles per day. PGDP-associated traffic is about 1,200 vehicle trips a day, which is less than 5 percent of daily traffic volume on US 60 and I-24.

Water

PGDP obtains all water from the Ohio River through an intake near TVA's Shawnee Fossil Plant north of the site. DOE treats the water on the site before using it. The maximum site treatment capacity is 30 to 32 million gallons per day, significantly higher than the average water use at the site of about 27 million gallons per day (DOE 2004).

The West McCracken County Water District serves residences and businesses in the area. It receives its water from Paducah Water, which is owned and operated by the City of Paducah. The West McCracken County Water District has an average daily use of 355,000 gallons. Paducah Water has excess capacity well above any needed local increases (WMCWD 2013).

Electricity

TVA, Kentucky Utilities Company, Jackson Purchase Energy Corporation, and Electric Energy Corporation provide electricity to the PGDP site. The nearest power plant is the TVA Shawnee Fossil Plant with nine operating coal-fired generating units and a summer generating capacity of 1,206 megawatts. Shawnee is about 3.5 miles north of the site on the Ohio River. TVA is planning one of three actions for two of Shawnee's generating units: conversion to renewable biomass, addition of scrubbers and other pollutant reduction systems, or closure. The Shawnee Fossil Plant is part of the integrated TVA power grid, a generating system with more than 34,000 megawatts of generating capacity, which is about 5,000 megawatts above recent peak demand summer peaking needs (Brooks 2013). In addition, the Kentucky Utilities Company, a regulated utility serving customers in 77 Kentucky counties and five Virginia counties, supplies electricity to area homes and buildings as part of LG&E/KU. LG&E/KU has a combined capacity of 8,185 megawatts, of which 4,833 megawatts are Kentucky Utilities facilities. The combined utility's peak demand in August 2010 was 7,175 megawatts. When the utility needs additional electricity to meet demand, it can draw through interconnections with other regional electricity providers (Feltham 2013).

Natural Gas

Atmos Energy Corporation, one of the nation's largest natural-gas-only distribution companies with customers in nine states, provides natural gas to the PGDP site, local residences, and other buildings. Natural gas lines at the site are plentiful in the industrial area where most activities have taken place.

3.11.2 ENVIRONMENTAL CONSEQUENCES

3.11.2.1 Industrial Use

To evaluate potential environmental impacts of the conceptual project, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1).

Transportation

Construction. The transport of materials and equipment for construction activities to accomplish development of the conceptual project would be over regional and local roadways to the site or via existing rail lines. DOE estimated that construction would require an average of 16 truck trips in and out of the site each day over a 1-year period. The additional amount of vehicle, and truck and rail traffic from operations associated with the new development would have a negligible impact on existing traffic because of the reduction of PGDP-related traffic from ceased operations (roughly 1,200 vehicles a day) and the fact that affected roadways and rail lines have sufficient design capacity.

Operations. Although potential operations at the conceptual project at the PGDP site could slightly increase traffic, the volume of traffic would not be likely to exceed historical traffic volumes that occurred during large employment periods at the site. A minor increase in the amount of traffic would

not substantially increase the chance of accidents. Installing standard traffic control actions such as turn lanes and additional traffic signals could mitigate potential impacts, if necessary. Therefore, impacts to transportation would likely be negligible or small.

Utilities

Construction. Development of the 500,000-square-foot facility would involve minimal infrastructure requirements. Electricity use during the year of construction would be about 6,000 megawatt-hours, and water use would be about 3 million gallons. Water use during construction would consist primarily of dust suppression and workforce needs, would come from the distribution system that already serves the site, and would be minor in comparison with the quantities currently used at the site (4 to 10 million gallons per day). Water use during construction would be less than what PGDP operations currently consume. There is sufficient capacity for these needs, so construction activities would likely have no impacts on utilities.

Operations. Future use of the PGDP real property, including the conceptual project, could involve electricity, natural gas, and water needs that would likely not exceed historical usage levels. In addition, existing utilities have adequate capacity to support additional development. DOE could transfer water and sewer facilities to the local community for continued operation. Although the likelihood and timing of such a transfer is uncertain, DOE does not expect it would affect the performance of the facility. Therefore, impacts to utilities would be negligible or small.

3.11.2.2 Recreation and Wildlife Management Uses

Use of the PGDP site for recreation and wildlife management would involve much less utility use and less traffic on local roadways because there would be little construction, no industrial or commercial operations, and few or no commuting workers or deliveries. Construction of facilities, if any, under this use would likely be less than under industrial uses. Therefore, impacts to infrastructure for recreation and wildlife management uses in either the developed or undeveloped areas of the site would be negligible.

3.12 Waste Management

3.12.1 AFFECTED ENVIRONMENT

3.12.1.1 Waste Generation and Management

The PGDP waste management program has procedures and facilities in place for the following eight categories of waste (LATA 2012a):

- Hazardous. Waste that meets the definition of hazardous under the *Resource Conservation and Recovery Act* and its implementing procedures.
- Mixed. Waste that contains both hazardous and radioactive components.
- Transuranic. Waste that contains more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.
- Low-Level Radioactive. Radioactive waste that is not high-level or transuranic waste.
- Polychlorinated Biphenyl (PCB). Waste that contains PCBs.
- Asbestos. Asbestos-containing materials from renovation and demolition activities.

- Solid. Refuse and industrial or construction debris suitable for landfill disposal.

- PCB Radioactive. PCB waste mixed with radioactive materials.

DOE operates one contained solid waste landfill at PGDP under Kentucky permit SW07300045 for the disposal of nonhazardous sanitary waste (refuse), soil and debris, and industrial waste (C-746-U Solid Waste Contained Landfill). The waste going to this landfill can contain small amounts of radioactivity, but cannot accept waste with radioactivity levels above authorized limits (DOE 2012a). DOE opened the landfill in 1997. In addition, DOE and USEC transport office waste and similar refuse to a permitted offsite landfill (LATA 2012a). In addition, there are three permitted and operating hazardous waste storage and treatment facilities on the PGDP site.

DOE decontamination, decommissioning, and cleanup activities are the primary source of waste at PGDP. The PGDP has a well-characterized and tracked inventory of equipment that contains or is contaminated with PCBs. DOE issues an annual report to EPA on the management of PCB materials, including disposition of PCB wastes, which come from management and replacement of equipment and from cleanup activities at sites with PCB contamination.

3.12.1.2 Waste Minimization

The PGDP Waste Minimization/Pollution Prevention Program complies with EPA and Kentucky regulations and DOE Directives. Activities include the evaluation of all PGDP projects for opportunities and implementing strategies for source reduction, waste segregation, reuse of materials, recycling, and procurement of recycled-content products (LATA 2012a). The recycled materials included paper, cardboard, batteries, various metals, tires, toner cartridges, wood pallets, oils, antifreeze, and fluorescent bulbs (LATA 2012a).

3.12.1.3 Burial Grounds

DOE is planning and implementing cleanup activities at the PGDP for historical burial grounds under several scopes of action to address various solid waste management units and areas of concern. DOE has grouped these units and areas into a media-specific Burial Grounds Operable Unit. The following discussion summarizes the objectives of the Burial Grounds Operable Unit and identifies the solid waste management units and areas of concern that are part of it.

Under the Burial Grounds Operable Unit, DOE is investigating, evaluating, and as appropriate, remediating historical burial grounds on the PGDP site. The Department is conducting these activities under the FFA, and the actions are subject to EPA and Kentucky review and approval. The sites in this operable unit contain various materials, including, but not limited to, sanitary waste (refuse), hazardous waste, radioactive waste, PCB waste, and pyrophoric uranium. Table 3-14 identifies the solid waste management units and areas of concern included in the Burial Ground Operable Unit and the Additional Burial Ground Sources Operable Unit. Figure 3-10 shows the locations of solid waste management units that make up the Burial Grounds Operable Unit. The Additional Burial Grounds Operable Unit SWMU/AOC (472 and 520) are not included in Figure 3-10.

Table 3-14 does not include two sites shown in Figure 3-10. Unit 208 is the active C-746-U Solid Waste Contained Landfill previously discussed; Unit 08 (008 in the figure) is the C-746-K Inactive Sanitary Landfill, which DOE will address in the Final Comprehensive Site Operable Unit (LATA 2012c).

DOE actions under the FFA for the Burial Grounds Operable Unit are ongoing. DOE has implemented institutional controls and groundwater monitoring measures, completed initial remedial investigations,

Table 3-14. Solid waste management units and areas of concern, Burial Grounds Operable Unit and Additional Burial Ground Sources Operable Unit (LATA 2012c).

SWMU No.	Description	SWMU No.	Description
Burial Grounds Operable Unit (pre-shutdown)			
2	C-749 Uranium Burial Ground	7	C-747-A Burial Ground
3	C-404 Low-level Radioactive Waste Burial Ground	9	C-746-S Residential Landfill
		10	C-746-T Inert Landfill
4	C-747 Contaminated Burial Ground	30	C-747-A Burn Area
5	C-746-F Classified Burial Ground	145	Residential/Inert Landfill Borrow Area (P-Landfill)
6	C-747-B Burial Ground		
Additional Burial Ground Sources Operable Unit (post-shutdown)			
472	C-746-B Pad	520	Scrap Material West of C-746-A

SWMU = solid waste management unit.

planned supplemental investigations for specific sites, and is developing feasibility studies (LATA 2012c).

3.12.2 ENVIRONMENTAL CONSEQUENCES

3.12.2.1 Industrial Use

Construction. To evaluate potential environmental impacts of industrial use, DOE assumed a future user would construct a 500,000-square-foot facility that would affect about 25 acres of land (see Table 2-1). Construction associated with new industrial uses would generate waste that new users would manage in accordance with Kentucky regulations. Construction would generate about 4,000 tons of nonhazardous wastes (mainly steel and concrete) and no hazardous wastes. The onsite landfill would not be available for use by any new real property users. New users of the real property would ship their waste off the site for disposition at facilities with appropriate operating permits. The nonhazardous waste would be disposed of at a local, permitted sanitary landfill or a local landfill permitted solely for construction-type debris. Adverse impacts would be unlikely as a result of construction activities.

Operations. Although DOE cannot know what types of industrial or commercial activities the site might host in the future, waste production from the conceptual project likely would not be greater than present levels. Future industrial uses could generate hazardous waste, but the users would be required to meet all applicable environmental laws and obtain any required permits. Users would likely manage nonhazardous and hazardous wastes separately and would send the wastes off site to treatment and disposal facilities. Therefore, adverse impacts, in comparison with existing conditions, as a result of operations would be unlikely.

3.12.2.2 Recreation and Wildlife Management Uses

Recreation and wildlife management uses would generate far less waste than the PGDP currently generates. Construction of facilities, if any, under this use would likely be less than under either of the other uses. Any waste generation from construction-related activities would be minimal and short in duration. Wastes associated with the operations of the recreation and wildlife management uses would be minimal and less than those associated with industrial operations. Therefore, recreation and wildlife management would not have adverse impacts on the waste management capabilities of the site or the region.

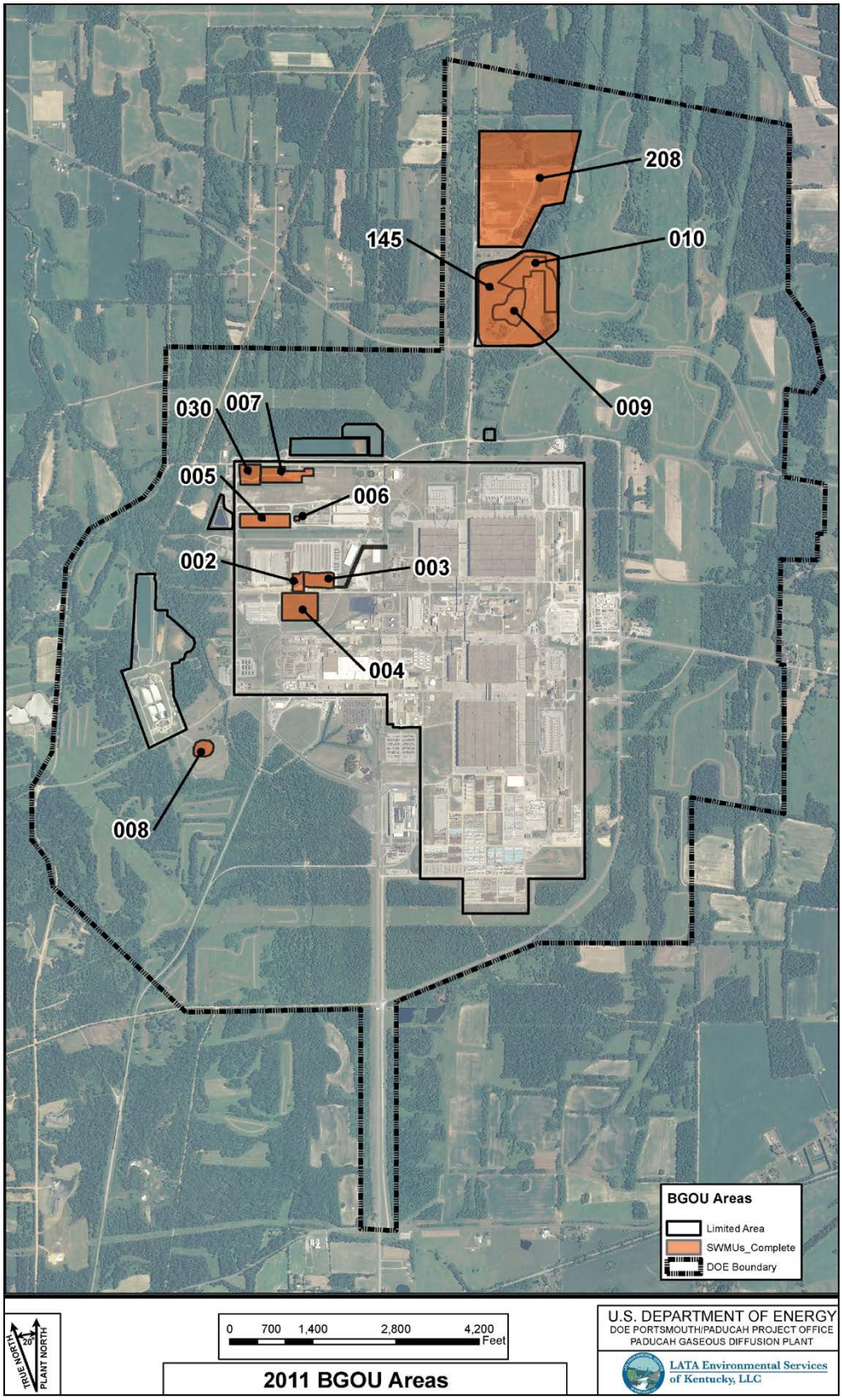


Figure 3-10. Locations of solid waste management units in the Burial Grounds Operable Unit (LATA 2012c).

3.13 Human Health and Safety

3.13.1 AFFECTED ENVIRONMENT

Past activities at the PGDP site have resulted in releases of radionuclides and chemicals to the environment. Each year, DOE releases a site environmental report on the surveillance of radiological and nonradiological contaminants in the environment around the site. The 2012 annual site environmental report is the most recent available. These reports are available to members of the public (http://www.pppo.energy.gov/annual.html). Existing contamination at the site would remain a small and decreasing potential source of exposure to members of the public. Radionuclides that are most likely to be sources of exposure include isotopes of uranium and technetium-99. Potentially present at much lower levels are isotopes of plutonium, neptunium-237, americium-241, and cesium-137. Some of these radionuclides might be present in the area background radiation, typically from atmospheric fallout. Chemicals that could be present include arsenic, hydrogen fluoride, fluoride ion, and PCBs. The 2012 annual site environmental report (LATA 2014) indicates that existing levels of these contaminants in the environment around the PGDP site are low.

Under DOE Order 458.1, *Radiation Protection of the Public and the Environment*, the dose limit for a member of the public from all exposure pathways and all radionuclide releases from the PGDP site cannot exceed 100-millirem effective dose equivalent in a calendar year. Continuing operations at the DUF_6 Facility would be subject to this limit, as well as other limits such as those implementing the Clean Air Act in 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities."

In terms of potential future events that could harm workers or the public, the accidents of most concern at the PGDP site would be those that could cause a release of DUF_6 from cylinders. The particular concern would be the chemical effects of such accidents. DOE previously examined accidents considered likely but with low consequence and extremely unlikely but with high consequences (DOE 2004). After a release, the UF_6 could combine with moisture in the air and form gaseous hydrogen fluoride and uranyl fluoride, a soluble solid in the form of small particles. The depleted uranium and hydrogen fluoride could disperse downwind and expose members of the public working or living near the site to radiation and chemical effects. DOE determined that the more likely, low-consequence accidents would not affect the public but that the extremely unlikely, high-consequence accidents could affect human health. For the high-consequence accidents, DOE estimated there would be no fatalities and 1 case of irreversible effects. The number of severely affected individuals in an extremely unlikely DUF_6 conversion project accident could increase over these estimates if members of the public were present in a land transfer area close to the facility when the event occurred.

3.13.2 ENVIRONMENTAL CONSEQUENCES

3.13.2.1 Industrial Use

Construction. Construction workers for the conceptual project would be subject to typical hazards and occupational exposures of industrial construction sites. Falls, spills, vehicle accidents, confined-space incidents, and injuries from tool and machinery operation could occur.

Operations. Operational accidents associated with the conceptual project could result from operator error, equipment malfunction, or from natural phenomena (for example, earthquakes, tornadoes, flooding, and fire). Potential hazards from the operation of facilities could include electrical energy; flammable materials; toxic, corrosive, or reactive materials; and radiation sources.

Other hazards could include kinetic and stored energy. Examples of kinetic energy hazards include moving ventilation system components, forklifts, and other drum- or box-handling equipment. Stored energy hazards include elevated structures and equipment, stacked drums, and boxes; electrical energy and pneumatic systems. New users would be subject to the same level of safety and health protection at similar developments; companies would follow applicable Occupational Safety and Health Administration and Kentucky requirements. Workers would receive applicable training and appropriate controls and oversight. The potential for fires and resulting adverse impacts would be mitigated by a transferee's compliance with all applicable building and fire protection codes.

3.13.2.2 Recreation and Wildlife Management Uses

Use of the PGDP site for recreation and wildlife management would involve very little construction, if any. Human health risks for this use would be those associated with the maintenance of land and recreational space, and for the public, those associated with outdoor activities. DOE does not expect there would be unique occupational health and safety hazards for recreation and wildlife management.

3.14 Intentionally Destructive Acts

DOE regulations require consideration of intentionally destructive acts, such as sabotage and terrorism, in an EA. After review, DOE determined that the likelihood of such acts is extremely low. While it is possible random acts of vandalism could happen as in any other location, DOE expects future industrial or commercial users would implement security measures typical of small industrial parks and other commercial developments. Intentionally destructive acts in the land transfer area would be very unlikely to affect the DUF_6 Facility or remediation sites. The potential for destructive acts at the DUF_6 Facility is beyond the scope of this EA and is addressed in that facility's *National Environmental Policy Act of 1969* (42 U.S.C. 4321 et seq.) documentation (DOE 2004).

CHAPTER 4. CUMULATIVE IMPACTS

4.1 Introduction

The CEQ regulations that implement the procedural provisions of NEPA define a cumulative impact as the "impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7)." Using this definition, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities that affect or will affect that resource no matter what entity is taking the actions.

DOE based the following cumulative impact analysis on the Proposed Action of transferring real property at the PGDP site to one or more entities and current and reasonably foreseeable actions (Section 4.2). Based on the analysis in Chapter 3 of this EA, the cumulative impact analysis (Section 4.3) focused on those resources with the greatest potential to be meaningfully affected. Those resource areas are land use, air quality, geology and soils, and water resources. DOE conducted this analysis in accordance with the CEQ regulations and handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997b).

4.2 Current and Reasonably Foreseeable Actions

DOE reviewed information on past, present, and reasonably foreseeable future projects and actions that could result in impacts over the same period and in the same general location as PGDP. To determine cumulative impacts from past, present, and reasonably foreseeable projects, DOE conducted online research to account for significant changes that could occur in the region. DOE focused in particular on reasonably foreseeable projects on and around the PGDP because projects nearer to the site would contribute more to cumulative impacts than projects farther away. Through this process, DOE identified two current or reasonably foreseeable actions in the region that could contribute to cumulative impacts in conjunction with the Proposed Action in this EA. As specific proposals are submitted for use of transferred lands, DOE would evaluate the need for additional NEPA analysis, which would include a reevaluation of cumulative impacts. The following sections describe these actions.

4.2.1 OHIO RIVER TRIPLE RAIL MEGASITE

Paducah Economic Development (PED), which is the economic development agency for Paducah and McCracken County, has identified a previously undeveloped 581-acre parcel of land to the northeast of the PGDP site as a location for future development called the Ohio River Triple Rail Megasite (PED 2013). The site (Figure 4-1) includes about 100 acres in a floodplain.

The site is in an area of residential housing and agricultural land along the Ohio River. The current landowners include residential homeowners, farmers, and the Paducah Riverport Authority. The TVA Shawnee Fossil Plant lies to the west of this site.

The proposed development would include industrial and commercial uses. As proposed, development activities would include construction of a rail spur and a barge dock. No details are available at this time of specific proposals for development.

Figure 4-1. Location of the Ohio River Triple Rail Megasite (PED 2013).

4.2.2 SHAWNEE FOSSIL PLANT

The TVA Shawnee Fossil Plant is about 3 miles northeast of the main PGDP facilities and has nine active generating units that burn about 9,600 tons of coal per day. The plant boundary is as close as 0.5 mile to the potential land transfer area (see Figure 1-1 in Chapter 1) (TVA 2013). Figure 4-2 is an aerial view.

Figure 4-2. Aerial view of Shawnee Fossil Plant.

The plant produces electricity by heating water in coal-fired boilers to produce steam. Under extremely high pressure, the steam flows into a turbine that spins a generator to make electricity. Shawnee generates about 8 billion kilowatt-hours of electricity a year, enough to supply 540,000 homes.

4.3 Environmental Consequences

4.3.1 LAND USE

Development at the Ohio River Triple Rail Megasite would convert about 581 acres from residential and agricultural use to industrial or commercial use. The site is currently zoned as Heavy Industrial. This proposed future land use would be consistent with regional land use zoning. Cumulative impacts to regional land use and land use plans would therefore be minimal.

4.3.2 AIR RESOURCES

No companies have proposed to build facilities at the Ohio River Triple Rail Megasite at this time, but industrial use of the real property could result in increased air emissions. Future users of the real property would have to obtain all applicable environmental permits, including air emission permits, so impacts to air quality would be minimized.

The TVA Shawnee Fossil Plant was the major contributor to criteria air pollutants in McCracken County during 2008, the latest year for which emission reports are available (EPA 2013). TVA has recently taken several steps to reduce emissions at Shawnee:

- Units 1 through 9 burn a blend of low-sulfur coal to limit sulfur dioxide emissions and use low-nitrogen oxide burners to reduce emissions of nitrogen oxides.

- TVA idled Unit 10, formerly a fluidized bed combustion boiler project, in October 2010 and is evaluating it for conversion to generating power from biomass such as wood waste.

- As part of the TVA vision of being one of the nation's leading providers of low-cost and cleaner energy by 2020, the agency has said it will either retire Shawnee Units 1 and 4 by December 31, 2017 or will convert them to renewable biomass and control emissions with scrubbers and selective catalytic reduction systems.

Additional information on Shawnee Fossil Plant air emissions is available from the TVA website at http://www.tva.com/sites/shawnee.htm. Regional air emissions, primarily driven by the Shawnee plant, should decrease over time as TVA implements the items discussed above. Based on TVA's planned actions, cumulative regional air emissions would also decrease over time.

4.3.3 GEOLOGY AND SOILS

The development of the Ohio River Triple Rail Megasite could result in disturbance of about 581 acres for construction of facilities, roads, parking lots, rail spurs, utilities, and so forth. Construction would disturb soils and alter topography through grading and placement of fill material. The potential impacts would be small and temporary.

Continued operation of the TVA Shawnee Fossil Plant, regardless of fuel type, would have little to no impact on geology and soils.

4.3.4 WATER RESOURCES

Development at the Ohio River Triple Rail Megasite would have minimal impact on wetlands because the site has less than 5 acres of wetlands and developers would have to follow federal and Kentucky wetlands protection requirements. Therefore, cumulative impacts to wetlands in the region would be minimal.

The TVA Shawnee Fossil Plant would continue to use water from the Ohio River for once-through cooling. Based on the reduced water use at the PGDP site, cumulative impacts from future uses would be minimal.

CHAPTER 5. RESOURCE COMMITMENTS

5.1 Unavoidable Adverse Impacts

Unavoidable adverse impacts are the effects on natural and human resources that would remain after mitigation measures or best-management practices have been applied to a proposed action. The practices are typically implemented to reduce a potential impact to a level that would be below the threshold of significance as defined by the CEQ and the courts.

In relation to the potential impacts of construction and operation of the conceptual project, the following residual adverse impacts could be expected after the application of best management practices or mitigation measures:

- Lands at the PGDP site that are currently open space would continue to be idle unless land transfers result in the conversion (about 25 acres) to industrial or other long-term uses.

- During construction of the conceptual project, topsoil could be graded and stockpiled before reuse or disposal; in the interim, even with the use of best-management practices, some soil could be lost through wind and water erosion.

- During construction, best-management practices would be implemented but there could still be some uncontrolled runoff that could affect nearby outfalls and water bodies.

- New or renovated facilities and support structures would result in land disturbance and the clearing of native vegetation, which could result in long-term changes in species composition and habitat characteristics.

- Operations of the conceptual project could have effluents and emissions after the application of best engineering designs and management practices.

Some mitigation or best-management practices cannot be fully effective. However, DOE expects that residual adverse impacts would be minor and not approach the threshold of significance. As specific project proposals are identified, the Department would evaluate the need for additional NEPA analysis.

5.2 Relationship Between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This section describes how the Proposed Action would affect short-term use and long-term productivity.

If real property is transferred to other private or public entities, the Purpose and Need for transferring idle PGDP lands and facilities would be fulfilled by increased site activity through new industry or other productive uses, facility reuse, and the creation of jobs. A construction phase would result in temporary construction and support jobs. After that, the site would be productive through the operational lives of new businesses.

5.3 Irreversible and Irretrievable Commitment of Resources

A commitment of resources is irreversible if its direct or secondary impacts limit future options for a resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for later use by future generations. Examples include nonrenewable resources, such as minerals and energy, and renewable resources that would be unavailable for the use of future generations, such as loss of production, harvest, or habitat.

Under the Proposed Action, DOE would transfer real property at the PGDP site in whole or in part, for reasonably foreseeable redevelopment. While an action might result in the loss of a resource that is irretrievable, the action might be reversible. Irreversible and irretrievable commitments of resources relate primarily to construction activities. These resource impacts are considered impacts to nonrenewable resources. In relation to the redevelopment of the site, most resource commitments are neither irreversible nor irretrievable and are considered short-term and temporary. Specifically, resources that construction activities would require, including labor, fossil fuels, and construction materials, would be committed for the life of the project. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline and diesel-powered construction equipment during construction. In addition, construction materials would be consumed. However, at some point in the future, some of the materials, such as metals, could be recycled.

In terms of the commitment of resources once construction has concluded and operations of a new facility like the conceptual project commence, the potential commitment of resources would be dependent on the type and magnitude of the operations. It is assumed that an industrial facility would involve the use of fossil fuels through vehicular traffic and the use of electricity. Water would be required for the support of employees and could be required, along with chemicals, to run various processes key to the facility's operations.

CHAPTER 6. REFERENCES

3M (3M Corporation), 2011, "Noise Hazard, 1. How loud is it? - (I) See our simplified noise thermometer," 3M Corporation, http://www.e-a-r.com/hearingconservation/faq_main.cfm (accessed March 15, 2013).

ANL (Argonne National Laboratory), 1991, *Environmental Site Description for a Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) Production Plant at the Paducah Gaseous Diffusion Plant Site*, ANL/EAIS/TM-57, Argonne, Illinois, September, http://www.osti.gov/bridge/servlets/purl/5113908/5113908.pdf (accessed March 14, 2013).

ANL (Argonne National Laboratory), 2004a, *Floodplain/Wetland Assessment of the Effects of Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site*, ANL-04/37, Argonne, Illinois, April, http://www.ipd.anl.gov/anlpubs/2005/09/54408.pdf (accessed March 14, 2013).

ANL (Argonne National Laboratory), 2004b, *Biological Assessment of the Effects of Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site*, ANL-04/36, Argonne, Illinois, February, http://www.ipd.anl.gov/anlpubs/2005/09/54407.pdf (accessed March 14, 2013).

BEA (U.S. Bureau of Economic Analysis), 2013, *Local Areas Personal Income and Employment, Personal Income and Population (CA1-3)*, U.S. Department of Commerce, Washington, D.C., http://www.bea.gov with navigation (accessed February 25, 2013).

BJC (Bechtel Jacobs Company), 2006, *Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, BJC/PAD-691/R1, Paducah, Kentucky, March, http://latakentucky.com/PublicDocuments/Cultural%20Resource%20Management%20Plan%20March%202006/BJC-PAD-691R1%20Paducah%20Cultural%20Resource%20Management%20Plan%202006-03.pdf

Blankenship, M., 2012, "Re: employment levels," e-mail to T. Duncan, U.S. Department of Energy, Portsmouth/Paducah Project Office, Paducah, Kentucky, May 16.

BLS (U.S. Bureau of Labor Statistics), 2013, *Local Area Unemployment Statistics*, *2000-2010 by Selected States and Counties*, U.S. Department of Commerce, Washington, D.C., http://www.bls.gov/data with navigation (accessed February 25, 2013).

Brooks, S., 2013, "RE: Dept. of Energy Paducah Environmental Assessment," e-mail to S. Frank (Philotechnics Dade Moeller), Tennessee Valley Authority, Nashville, Tennessee, March 5.

CEQ (Council on Environmental Quality), 1997a, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., December 10, http://www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf (accessed March 15, 2013).

CEQ (Council on Environmental Quality), 1997b, *Considering Cumulative Effects Under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., January, http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf (accessed March 15, 2013).

CH2M Hill Southeast, TMA/Eberline, C. C .Johnson & Malhotra, SAIC, Martin Marietta Energy Systems, 1992, *Results of the Site Investigation, Phase II, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P03/1991/1, Oak Ridge, Tennessee, April, http://www.paducaheic.com/media/42646/i-02400-0224a-ARI53.pdf (accessed March 15, 2013).

Colby, W. D.; Dobie R.; Leventhall G.; Lipscomb, D. M.; McCunney, R. J.; Seilo, M. T.; Sondergaard, B., 2009, *Wind Turbine Sound and Health Effects: An Expert Panel Review*, American Wind Energy Association, Washington, D.C., December 11.

DOE (U.S. Department of Energy), 2000, *Land Use Control Assurance Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1799&D2, Office of Environmental Management, Washington, D.C., January.

DOE (U.S. Department of Energy), 2004, *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site*, DOE/EIS-0359, Office of Environmental Management, Washington, D.C., June 18, http://energy.gov/nepa/eis-0359-uranium-hexafluoride-conversion-facility-paducah-kentucky-site (accessed February 19, 2013).

DOE (U.S. Department of Energy), 2006, *Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2179&D2/R1, Office of Environmental Management, Washington, D.C., August, http://latakentucky.com/PublicDocuments/Burial%20Grounds%20Operable%20Unit%20(BGOU)/BGOU%20RI%20Work%20Plan/BGOU%20RIFS%20Work%20Plan%20D2R1%20Revisions%20(DOE-OR-07-2179&D2-R1).pdf (accessed February 19, 2013).

DOE (U.S. Department of Energy), 2011, "Community Visions for the Paducah Gaseous Diffusion Plant (PGDP), Portsmouth/Paducah Project Office, Lexington, Kentucky.

DOE (U.S. Department of Energy), 2012a, "DOE Paducah Site Tour – Paducah Gaseous Diffusion Plant (PGDP) – Industry Workshop," July 31, Portsmouth/Paducah Project Office, Lexington, Kentucky.

DOE (U.S. Department of Energy), 2012b, "Paducah Gaseous Diffusion Plant (PGDP) – Industry Workshop," Office of Environmental Management, Portsmouth/Paducah Project Office, Lexington, Kentucky, July 31.

DOE (U.S. Department of Energy), 2013a, "Portsmouth Paducah Project Office," Office of Environmental Management, Washington, D.C..

DOE (U.S. Department of Energy), 2013b, *Final Environmental Assessment for the Transfer of the Kansas City Plant, Kansas City, Missouri*, DOE/EA-1947, National Nuclear Security Administration, February 14, http://energy.gov/sites/prod/files/2013/05/f0/EA-1947-FEA-2013.pdf (accessed June 21, 2013).

Ethridge, J., 2013, "WKWMA Presentation," e-mail to R. Smith (PGDP), EHI Consultants, Paducah, Kentucky, August 14.

EPA (U.S. Environmental Protection Agency), 2013, "2008 National Emissions Inventory, Version 2," April 10, 2012," http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc (accessed February 1, 2013).

FBI (Federal Bureau of Investigation), 2013, "Table 80, Kentucky, Full-time Law Enforcement Employees by State by Metropolitan and Nonmetropolitan Counties, 2011," Washington, D.C., http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/tables/table-80/10tbl80ky.xls (accessed February 27, 2013.

Feltham, C., 2013, "RE: Environmental Assessment for Department of Energy," e-mail to S. Frank (Philotechnics Dade Moeller), LGE-KU, February 12.

FEMA (Federal Emergence Management Agency), 2013, "Flood Insurance Rate Map," available from http://msc.fema.gov/portal with navigation, Washington, D.C. (accessed March 18, 2013).

FHWA (Federal Highway Administration), 2006, "Construction Equipment Noise Levels and Ranges," Chapter 9 in *Construction Noise Handbook*, FHWA-HEP-06-015, DOT-VNTSC-FHWA-06-02, U.S. Department of Transportation, Washington, D.C., August, http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm (accessed February 26, 2013).

Froede, C. R. Jr., 2000, "Paducah Gaseous Diffusion Plant Land Use Control Assurance Plan," letter to W. D. Seaborg (U.S. Department of Energy, Paducah Site Office) and M. V. Welsch (Kentucky Department for Environmental Protection), Region 4, Atlanta, Georgia, April 4.

Green, R., 2013, "RE: Land Area Descriptions," JAD Environmental, Richland, Washington, May 1.

Groppe, K., 2013, "SHPO Notes," e-mail to B. Craig, Philotechnics Dade Moeller, Richland, Washington, May 10.

IPCC (Intergovernmental Panel on Climate Change), 2007, *Climate Change 2007: Synthesis Report, Summary for Policy Makers*, Geneva, Switzerland, http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf (accessed March 15, 2013).

Jordan, Jones, & Goulding, 2002, *Paducah-McCracken County Transportation Study, Final Report,* Lexington, Kentucky, March, http://paducahky.gov/paducah/files/u3/TranspStudy2002.pdf (accessed February 8, 2013).

KCED (Kentucky Cabinet for Economic Development), 2013, *Community Data, Paducah, McCracken County*, Frankfort, Kentucky.

KDEP (Kentucky Department for Environmental Protection), 1998, "Authorization to Discharge Under the Kentucky Pollutant Discharge Elimination System, Permit No. KY0102083" Frankfort, Kentucky, March 13.

KDEP (Kentucky Department for Environmental Protection), 2010, *Integrated Report to Congress on the Condition of Water Resources in Kentucky, 2010, Volume I, 305(b) Assessment Results with Emphasis on the Big Sandy-Little Sandy-Tygarts Basin Management Unit and the Kentucky River Basin Management Unit*, Frankfort, Kentucky, April, http://water.ky.gov/waterquality/Integrated%20Reports/2010IntegratedReportFinal.pdf (accessed January 16, 2013).

KDEP (Kentucky Department for Environmental Protection), 2013a, "Division of Water – Basins – Watershed Viewer," http://gis.gapsky.org/watershed/ with navigation (accessed January 15, 2013).

KDEP (Kentucky Department for Environmental Protection), 2013b, "Drinking Water Branch – Public Water Supply Systems Search," Frankfort, Kentucky, http://dep.gateway.ky.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=1276&tinwsys_st_code=KY&wsnumber=KY0732457 (accessed January 17, 2013).

KDFWR (Kentucky Department of Fish and Wildlife Resources), 2012, "Kentucky's Bald Eagles," Frankfort, Kentucky.

KDFWR (Kentucky Department of Fish and Wildlife Resources), 2013, "2013 Wildlife Action Plan Revision– New!, Frankfort, Kentucky, February 5.

KDOW (Kentucky Division of Water), 2010, "Fact Sheet – Floodplain Management," Frankfort, Kentucky, September, http://water.ky.gov/Fact%20Sheets/Floodplain%20Management.pdf (accessed March 19, 2013).

KDOW (Kentucky Division of Water), 2011, "Fact Sheet, Storm Water General Permit for Construction Activities," Frankfort, Kentucky, January, http://water.ky.gov/Fact%20Sheets/Stormwater%20construction%20permit.pdf (accessed February 11, 2013).

KDOW (Kentucky Division of Water), 2013, "Division of Water, Kentucky Water Quality Certification Program," Frankfort, Kentucky, http://water.ky.gov/permitting/Pages/KYWaterQualityCertProg.aspx (accessed February 10, 2013).

KGS (Kentucky Geological Survey), 2010, "Seismic Hazard Assessment for Kentucky," University of Kentucky, Lexington, Kentucky, November 8, http://www.uky.edu/KGS/geologichazards/research_assessment.htm (accessed February 5, 2013).

Kreher, T., 2013, "RE: Meeting Tues," e-mail to R. Smith (PGDP), Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, March 19.

KSNPC (Kentucky State Nature Preserves Commission), 2012, *Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities for McCracken County, Kentucky*, Frankfort, Kentucky.

LATA (LATA Environmental Services of Kentucky), 2010, *Paducah Site Annual Site Environmental Report for Calendar Year 2009*, PAD-ENM-0053, Paducah, Kentucky, October, http://latakentucky.com/powercms/files/20101001%20ASER%202009%20%20Vol%201%20KSL.pdf and http://latakentucky.com/powercms/imagesupload/cms_files/20101001%20ASER%202009%20Data%20Volume%20KSL%20Rev%200.pdf (accessed January 18, 2013).

LATA (LATA Environmental Services of Kentucky), 2012a, *Paducah Site Annual Site Environmental Report for Calendar Year 2011*, PAD-REG-1012, Paducah, Kentucky, September, http://energy.gov/sites/prod/files/2014/12/f19/2011%20Paducah%20ASER%20REG.pdf (accessed February 4, 2013).

LATA (LATA Environmental Services of Kentucky), 2012b, *Paducah Site Annual Site Environmental Report for Calendar Year 2010*, PAD-REG-1009, Paducah, Kentucky, September, http://www.latakentucky.com/pubdocs/20120201%202010%20ASER%20Vol%20I%20REG%20CLEAN.pdf (accessed February 25, 2013).

LATA (LATA Environmental Services of Kentucky), 2012c, *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Annual Revision—FY 2013*, DOE/LX/07-1284&D2, Paducah, Kentucky, December, http://www.latakentucky.com/pubdocs/20121211%20D2%20FY%202013%20SMP%20Final%20REG%20AR%20File.pdf (accessed February 5, 2013).

LATA (LATA Environmental Services of Kentucky), 2014, *Paducah Site Annual Site Environmental Report for Calendar Year 2012*, PAD-REG-1018, Paducah, Kentucky, June, http://energy.gov/sites/prod/files/2014/12/f19/2012%20Paducah%20ASER.pdf (accessed September 9, 2014).

NCES (National Center for Education Statistics), 2013, "Search for Public School Districts, Detail for Ballard Co" [2010-2011 school year], "Search for Public School Districts, Detail for Carlisle Co" [2010-2011 school year], "Search for Public School Districts - Search Results" [Graves County], "Search for Public School Districts - Search Results" [Marshall County], "Search for Public School Districts - Search Results" [McCracken County], "Search for Public School Districts - Search Results" [Massac County], Washington, D.C., http://nces.ed.gov/ with navigation (accessed February 26, 2013).

NRCS (Natural Resources Conservation Service), 2013a, "Web Soil Survey," Spatial Data Version 3, December 7, 2009, Tabular Data Version 7, U.S. Department of Agriculture, Washington, D.C., http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx with navigation (accessed February 6, 2013).

NRCS (Natural Resources Conservation Service), 2013b, "Web Soil Survey," Spatial Data Version 3, December 7, 2009, Tabular Data Version 7, U.S. Department of Agriculture, Washington, D.C., http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx with navigation (accessed February 4, 2013).

NRCS (Natural Resources Conservation Service), 2013c, "Web Soil Survey," Spatial Data Version 3, December 7, 2009, Tabular Data Version 7, U.S. Department of Agriculture, Washington, D.C., http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx with navigation (accessed February 8, 2013).

PED (Paducah Economic Development), 2013, Ohio River Triple Rail Megasite, Paducah, McCracken County, Kentucky," Paducah, Kentucky.

PRS (Paducah Remediation Services), 2008, *Update to the End State Vision for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0013&D1, Paducah, Kentucky, May, http://www.latakentucky.com/public_documents.asp (accessed January 21, 2013).

PRS (Paducah Remediation Services), 2009, *Community Relations Plan Under the Federal Facility Agreement at the U.S. Department of Energy Paducah Gaseous Diffusion Plant*, DOE/OR/07-2099&D2/R6, Paducah, Kentucky, November, http://www.latakentucky.com/pubdocs/CMP-L-0011_CRP-R6_Ltr&Doc.pdf (accessed May 13, 2013).

Pruitt, L.; TeWinkel, L., editors, 2007, *Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision*, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota, http://www.fws.gov/ecos/ajax/docs/recovery_plan/070416.pdf (accessed March 15, 2013).

TVA (Tennessee Valley Authority), 2013, "Shawnee Fossil Plant," Knoxville, Tennessee, http://www.tva.com/sites/shawnee.htm# (accessed February 14, 2013).

USACE (U.S. Army Corps of Engineers), 1994a, *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume I, Executive Summary, Final Report*, Waterways Experiment Station, Vicksburg, Mississippi, and Engineer District Nashville, Nashville, Tennessee, May http://latakentucky.com/PublicDocuments/COE%201995%20-%20Environmental%20Investigations/COE_EnvInvest-Vol1.pdf (accessed February 4, 2013).

USACE (U.S. Army Corps of Engineers), 1994b, *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky; Volume II, Wetlands Investigation, Final Report*, Waterways Experiment Station, Vicksburg, Mississippi, and Engineer District Nashville, Nashville, Tennessee, May, http://latakentucky.com/PublicDocuments/COE%201995%20-%20Environmental%20Investigations/COE_EnvInvest-Vol2.pdf (accessed February 23, 2013).

USACE (U.S. Army Corps of Engineers), 1994c, *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky; Volume III, Threatened and Endangered Species Investigation, Final Report*, Waterways Experiment Station, Vicksburg, Mississippi, and Engineer District Nashville, Nashville, Tennessee, May, http://latakentucky.com/PublicDocuments/COE%201995%20-%20Environmental%20Investigations/COE_EnvInvest-Vol3.pdf (accessed February 23, 2013).

USACE (U.S. Army Corps of Engineers), 1994d, *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume IV, Cultural Resources Investigation, Part B, Sensitivity Analysis, Final Report*, Waterways Experiment Station, Vicksburg, Mississippi, and Engineer District Nashville, Nashville, Tennessee, May, http://latakentucky.com/PublicDocuments/COE%201995%20-%20Environmental%20Investigations/COE_EnvInvest-Vol4B.pdf (accessed February 23, 2013)..

USCB (U.S. Census Bureau), 2012, "Poverty Thresholds 2010, Poverty Thresholds for 2010 by Size of Family and Number of Related Children Under 18 Years," U.S. Department of Commerce, Washington, D.C., http://www.census.gov/hhes/www/poverty/data/threshld/thresh10.html, September 12 (accessed February 27, 2013).

USCB (U.S. Census Bureau), 2013a, "DP-1 Profile of General Population and Housing Characteristics: 2010," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed February 21, 2013).

USCB (U.S. Census Bureau), 2013b, "DP-1 Profile of General Population and Housing Characteristics: 2000, Census 2000 Summary File 1 (SF 1) 100-Percent Data," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed February 21, 2013).

USCB (U.S. Census Bureau), 2013c, "B25077 Median Value (Dollars) Universe: Owner-occupied housing units 2006-2010, American Community Survey 5-Year Estimates," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed February 21, 2013).

USCB (U.S. Census Bureau), 2013d, "DP05 2010 ACS Demographic and Housing Estimates 2006-2010 American Community Survey 5-Year Estimates," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed February 21, 2013).

USCB (U.S. Census Bureau), 2013e, *DP05 2010 Selected Economic Characteristics 2006-2010 American Community Survey 5-Year Estimates*, U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed February 21, 2013).

USCB (U.S. Census Bureau), 2015a, "DP-3 2000 Profile of Selected Economic Characteristics: 2000, Census 2000 Summary File 3 (SF 3) – Sample Data," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed May 28, 2015).

USCB (U.S. Census Bureau), 2015b, "DP03 2010 Selected Economic Characteristics 2006-2010 American Community Survey 5-Year Estimates," U.S. Department of Commerce, Washington, D.C., http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml with navigation (accessed May 28, 2015).

USEC (U.S. Enrichment Corporation), 2013, "Paducah Gaseous Diffusion Plant – Key Facts," Bethesda, Maryland, http://www.usec.com/gaseous-diffusion/paducah-gdp (accessed January 18, 2013).

USFA (U.S. Fire Administration), 2013, "USFA National Fire Department Census Download," Emmitsburg, Maryland, http://apps.usfa.fema.gov/census-download/main/download (accessed April 16, 2013).

USGS (U.S. Geological Survey) 2012a, "Earthquake Hazards Program, Historic Earthquakes, New Madrid 1811-1812 Earthquakes," U.S. Department of the Interior, Denver, Colorado, November 1, http://earthquake.usgs.gov/earthquakes/states/events/1811-1812.php (accessed May 6, 2013).

USGS (U.S. Geological Survey), 2012b, *Water-Data Report 2011, 03611500 Ohio River at Metropolis, IL*, U.S. Department of the Interior, Denver, Colorado, http://wdr.water.usgs.gov/wy2011/pdfs/03611500.2011.pdf (accessed January 15, 2013).

USGS (U.S. Geological Survey), 2013a, "ShakeMap Scientific Background, U.S. Department of the Interior, Denver, Colorado, http://earthquake.usgs.gov/earthquakes/shakemap/background.php (accessed February 5, 2013).

USGS (U.S. Geological Survey), 2013b, "Estimated Use of Water in the United States, County-Level Data for 2005, Data Files for Kentucky," U.S. Department of the Interior, Denver, Colorado, January 22, http://water.usgs.gov/watuse/data/2005/ (accessed April 1, 2013).

WADOT (Washington State Department of Transportation), 2001, *Noise Mitigation and Design Options, Methods of Analysis and Mitigation for Traffic and Transit Projects*, Seattle, Washington, April 21.

WMCWD (West McCracken County Water District), 2013, "Water," e-mail to S. Frank (Philotechnics Dade Moeller & Associates), West Paducah, Kentucky, February 6.

APPENDIX A. PUBLIC PARTICIPATION

DOE announced a public information meeting through advertisements in local newspapers and in a postcard (page A-2) to about 1,500 local residents, elected officials, and other interested parties. DOE held the meeting on Tuesday, March 19, 2013; about 40 people attended. The meeting included a formal presentation and a question and answer session. Questions about covered topics included details of future transfers, future responsibility for cleanup of the site, and what areas of the PGDP DOE would include in the EA analysis. The following organizations and individuals participated in the information meeting DOE held on this EA:

Organizations

- Ballard County Economic and Industrial Development Board
- Central Kentucky Retriever Club
- Kentucky Department of Fish and Wildlife Resources
- Kentucky Department for Environmental Protection, Division for Air Quality
- Kentucky Department for Environmental Protection, Division of Waste Management
- LATA Environmental Services
- LATA Kentucky
- McCracken County Fiscal Court
- Murray State University
- Paducah Citizens Advisory Board
- Ohio Valley Field Trial Circuit/Amateur Field Trial Clubs of America
- S.M. Stoller
- Security, Police and Fire Professionals of America Local 111
- Swift & Staley
- University of Kentucky
- United States Enrichment Corporation
- West Kentucky Field Trial Club

Individuals

- Renie Barger
- Anita Beardsley
- Eric Beardsley
- Jay Beech
- Allen Burnett
- Judy Clayton
- Clyde Elrod
- Tom Grassham
- Ronald & Doris Lamb
- Gary Mattingly
- Dianne O'Brien
- Shane Rice
- Eric Roberts
- Dick Rushing
- Jim Tortorelli
- Ken Wheeler
- Ralph Young

PUBLIC INFORMATION MEETING

The U.S. Department of Energy (DOE) Paducah Portsmouth Project Office is planning to prepare the:
Paducah Gaseous Diffusion Plant (PGDP) Environmental Assessment (EA) for Potential Land and Facility Transfers (DOE/EA 1927)

The EA will analyze and describe the potential environmental impacts associated with potential land and facility transfer. The EA will be prepared in accordance with the National Environmental Policy Act (NEPA).

A public information meeting will be held to provide the public with additional information about the EA. The meeting will be held:

Tuesday, March 19, 2013
Open House: 6:00 pm – 7:00 pm • Presentation: 7:00 pm
West Kentucky Technical and Community College Center for Emerging Technology
4810 Alben Barkley Drive • Paducah, Kentucky 42001

For additional information, or if you need special assistance at the meeting, please contact Mr. Buz Smith, Paducah Strategic Planner, Department of Energy-Paducah, 5600 Hobbs Rd. C103, Paducah KY 42002-1410, or by email to robert.smith@lex.doe.gov

APPENDIX B. CORRESPONDENCE

This appendix contains copies of:

- The letter from the U.S. Department of Energy (DOE) to the Kentucky Field Office of the U.S. Fish and Wildlife Service (page B-2),
- The response from the U.S. Fish and Wildlife Service to DOE (page B-8),
- An example of the letter DOE sent to the 10 American Indian tribes noted in the distribution list (page B-10), and
- The response from the Office of the Chief of the Cherokee Nation (page B-15).

Department of Energy

Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513
(859) 219-4000

JUN 12 2013

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

PPPO-01-1927046-13A

Dear Mr. Andrews:

SITEWIDE ENVIRONMENTAL ASSESSMENT AT THE PADUCAH GASEOUS DIFFUSION PLANT

The U.S. Department of Energy (DOE) has owned and operated all or parts of the Paducah Gaseous Diffusion Plant (PGDP) site in McCracken County, Kentucky, since 1950. About 10 miles west of the City of Paducah and 3.5 miles south of the Ohio River, the current DOE land holdings encompass 3,556 acres, of which about 800 acres are within the PGDP security fence. The Paducah site began operations in 1952 to produce low-assay enriched uranium for use in nuclear weapons and military reactors in the early years and enriched uranium for commercial reactor fuel in the later years. In 1993, DOE leased the uranium enrichment facilities to the United States Enrichment Corporation (USEC). USEC has indicated that it will cease operating the enrichment facility. DOE Environmental Management (EM) is focusing its resources and efforts on environmental restoration of the site, which includes clean up of contaminated environmental media and decontamination and decommissioning of certain facilities. DOE is managing waste from those activities, as well as legacy waste from the operational period of the PGDP.

DOE anticipates that in the future it will not need all of the land and/or facilities at the PGDP site. DOE is, therefore, considering the potential transfer of real property at the PGDP. Property transfers could be by title, lease, or easement. DOE could enter into agreement(s) with federal, Commonwealth of Kentucky, and/or local governments or private entities, such as the Paducah-Area Community Reuse Organization. DOE is considering such transfers to reduce the footprint of the site and to enhance economic development within the community.

Pursuant to its responsibilities under the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 et seq.), DOE is evaluating this Proposed Action in the PGDP Environmental Assessment (EA) for Potential Land and Facilities Transfer in McCracken County, Kentucky. Under the Proposed Action, DOE could transfer real property at the PGDP site to one or more entities that could use the property for mixed uses, including industry, commerce, recreation, and wildlife management. The PGDP site is currently zoned for heavy industry under McCracken County ordinance. The EA will evaluate the potential environmental impacts of these types of potential future uses. DOE would retain and not transfer lands and buildings associated with the

Depleted Uranium Hexafluoride (DUF_6) Conversion Plant and supporting facilities and structures, burial grounds, or cells that contain waste that is regulated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA; 42 U.S.C. 9601 et seq.). DOE will continue to use the DUF_6 Plant to convert DUF_6 into a more stable chemical form suitable for beneficial reuse or disposal. DOE expects this facility to continue to operate for about 25 years.

In keeping with its responsibility to protect federal trust resources, the EA will evaluate potential impacts to threatened and endangered species and migratory birds as required under the Endangered Species Act (ESA) and the Migratory Bird Treaty Act. DOE has accessed the U.S. Fish and Wildlife Service (USFWS) endangered species web site and determined that 10 federally listed endangered species potentially occur in McCracken County. These species include one bird, the least tern (*Sterna antillarum*), eight species of clams, and the Indiana bat (*Myotis sodalis*) (Table 1). Habitat for the least tern and the eight species of clams does not occur on the PGDP site. Therefore, the only species DOE plans to evaluate under the ESA is the Indiana bat. DOE requests that the USFWS confirm that this list of species is correct. Potential impacts to the Indiana bat have been previously evaluated for other projects at the PGDP site, most recently for the Final Environmental Impact Statement for the Construction and Operation of a DUF_6 Conversion Facility at the Paducah, Kentucky Site (DOE/EIS-0359) in 2004.

The existing level of land development varies greatly across the PGDP site; potential impacts to the Indiana bat from redevelopment would vary based on current habitat conditions. In the center of the PGDP site are the PGDP and DUF_6 Plants within an 800-acre fenced and highly developed industrial area surrounded by an area containing access roads, several large parking lots, several water impoundments, and a mixture of mown grass fields and small stands of trees. DOE expects that industrial or commercial redevelopment in this area would have no adverse effect on the Indiana bat.

Beyond the inner more highly developed center of the PDGP site is a perimeter of less developed property that extends to the property line and encircles the inner developed area (Figure 1 and 2). This outer perimeter is the least developed and contains a mixture of habitats including early, mid-, and late successional hardwood forest, riparian zones, palustrine wetlands, old fields, fence lines, and mown grass fields. DOE currently licenses 1,986 acres of this outer less developed area to the Commonwealth of Kentucky for management as part of the Western Kentucky Wildlife Management Area, which borders the PGDP site on the south, west, and north sides. In January 2012, DOE signed a new 5-year license agreement with the Kentucky Department of Fish and Wildlife Resources for this part of the Paducah site. The agreement expanded the permissible public recreational activities. The potential impacts to the Indiana bat may vary based on differences in existing land use and the type of redevelopment activities.

DOE cannot know specific proposed uses before a land transfer or at a minimum until it has received and reviewed proposals for transfers. Therefore, DOE has developed reasonably foreseeable uses in the EA to bound the analysis. DOE does not anticipate conducting formal Section 7 consultation for this EA because the specific redevelopment actions are not known. However, the EA will discuss land use encumbrances or restrictions including possible future Section 7 or Section 10 consultations that could be required for future developments in areas that could adversely impact endangered or threatened species.

As noted, DOE requests that the USFWS confirm that this list of species is correct. Please reply to:

Pete J. Yerace
Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, KY 40513
E-mail: pete.yerace@emcbc.doe.gov
Phone: 513-246-0528

Thank you in advance for your consideration.

Sincerely,

William E. Murphie
Manager
Portsmouth/Paducah Project Office

Enclosures:
Table 1. Threatened or endangered species that might occur in McCracken County, Kentucky.
Figure 1. Aerial photograph of the PGDP site and immediate vicinity
Figure 2. Major features of the PGDP site

cc w/enclosures:
Robert.Edwards@lex.doe.gov, PPPO/LEX
Rachel.Blumenfeld@lex.doe.gov, PPPO/PAD
Cynthia.Zvonar@lex.doe.gov, PPPO/LEX
Lisa.Santoro@lex.doe.gov, PPPO/PAD
Robert.Smith@lex.doe.gov, PPPO/PAD
Laura.Roenker@lex.doe.gov, PPPO/LEX
Pete.Yerace@emcbc.doe.gov, EMCBC

Table 1. Threatened or endangered species that might occur in McCracken County, Kentucky.

Group	Species	Common name	Legal* Status	Known** Potential
Mammals	*Myotis sodalis*	Indiana bat	E	K
Clams	*Potamilus capax*	fat pocketbook	E	K
	Plethobasus cooperianus	orangefoot pimpleback	E	K
	Lampsilis abrupta	pink mucket	E	K
	Obovaria retusa	ring pink	E	K
	Plethobasus cyphyus	Sheepnose mussel	E	P
	Pleurobema clava	clubshell	E	P
	Cyprogenia stegaria	fanshell	E	P
	Cumberlandia monodonta	Spectaclecase mussel	E	P
Birds	*Sterna antillarum*	interior least tern	E	P

NOTES:

* Key to notations: E = Endangered, T = Threatened, C = Candidate, CII = Critical IIabitat

**Key to notations: K = Known occurrence record within the county, P = Potential for the species to occur within the county based upon historic range, proximity to known occurrence records, biological, and physiographic characteristics.

Figure 1. Aerial photograph of the PGDP site and immediate vicinity

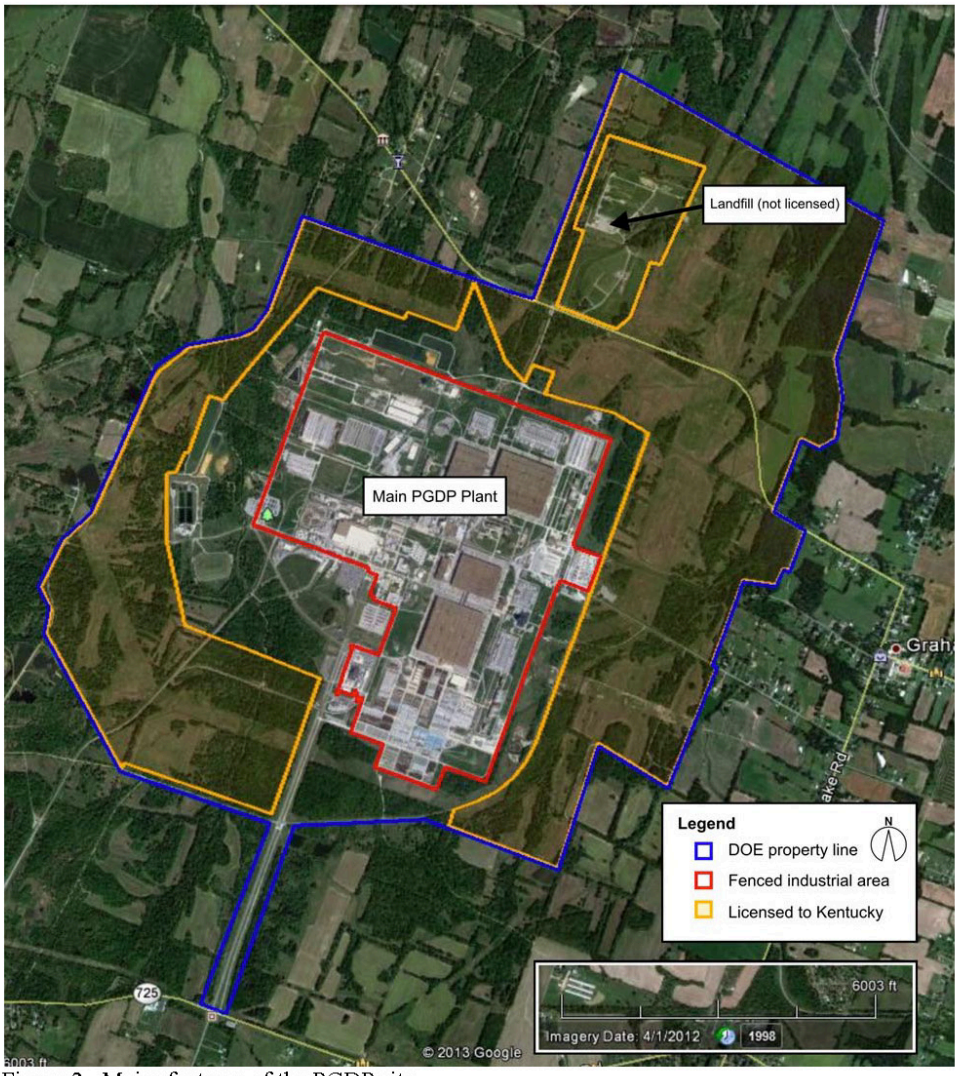


Figure 2. Major features of the PGDP site

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

June 21, 2013

Mr. William E. Murphie
Department of Energy
Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, KY 40513

Re: FWS 2013-B-0579; Paducah Gaseous Diffusion Plant property transfer; located in McCracken County, Kentucky

Dear Mr. Murphie:

Thank you for the opportunity to provide comments on the above-referenced project. The U.S. Fish and Wildlife Service (Service) has reviewed this proposed project and offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). This is not a concurrence letter. Please read carefully, as further consultation with the Service may be required.

Below, we have provided a list of federally listed species that we believe have the potential to occur within the proposed project vicinity. The list includes all of the species that you listed in your correspondence, with the addition of two additional mussel species.

Group	Species	Common name	Legal* Status
Mammals	*Myotis sodalis*	Indiana bat	E
Mussels	*Potamilus capax*	fat pocketbook	E
	Plethobasus cooperianus	orangefoot pimpleback	E
	Lampsilis abrupta	pink mucket	E
	Obovaria retusa	ring pink	E
	Plethobasus cyphyus	sheepnose	E
	Pleurobema clava	clubshell	E
	Pleurobema plenum	rough pigtoe	E
	Cyprogenia stegaria	fanshell	E
	Cumberlandia monodonta	spectaclecase	E
	Quadrula c. cylindrica	rabbitsfoot	P
Birds	*Sterna antillarum*	interior least tern	E

* *Key to notations: E = Endangered, T = Threatened, P = Proposed, C = Candidate, CH = Critical Habitat*

We must advise you that collection records available to the Service may not be all-inclusive. Our database is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitats and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality.

Indiana bat

Much of the PGDP site is located within the home range of a known Indiana bat maternity colony. The remaining area is considered "potential" Indiana bat maternity habitat. "Maternity habitat" refers to suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females, and is an essential component of the Indiana bat's lifecycle. Female Indiana bats become pregnant in the spring soon after they emerge from their hibernacula, usually caves, rockshelters, and mines. The pregnant females migrate to their maternity habitat and roost in "suitable roost trees," forming colonies of up to 100 or more individuals. A "suitable roost tree" is any tree (live or dead) with a diameter- at- breast- height (DBH) of 5-inches or greater that exhibits any of the following characteristics: exfoliating bark, crevices or cracks. Trees with a DBH of 5-inches or greater that are not "suitable roost trees," as previously defined, still serve as foraging habitat for the Indiana bat.

We have concerns about potential future tree removal on the property and the resulting loss of Indiana bat maternity roosting and foraging habitat. The available forested habitat within the home range of the known maternity colony is already relatively low and considered "sensitive." Of the potential uses of the property, those that would allow for the habitat to remain intact would be the most beneficial to the species. We are especially concerned about the potential transfer of land to private entities that do not have the obligation to consult with the Service regarding impacts to listed species. We recommend that DOE evaluate the potential for habitat loss among various uses and under ownership of various entities, and consider conservation measures in response to those potential losses.

Federally listed mussel species

You noted in your correspondence that habitat for the mussel species does not occur on the PGDP site. However, the site does contain streams that flow into the Ohio River where there is habitat for the mussel species. Future activities that impact the water quality of these streams (*e.g.,* siltation, discharge of pollutants) may subsequently impact federally listed mussel species in the Ohio River. These potential impacts should be considered in your evaluation.

Thank you again for your request. Your concern for the protection of endangered and threatened species is greatly appreciated. If you have any questions regarding the information that we have provided, please contact Jessi Miller at (502) 695-0468 extension 104.

Sincerely,

Virgil Lee Andrews

Virgil Lee Andrews, Jr.
Field Supervisor

2

Department of Energy

Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513
(859) 219-4000

JUN 12 2013

DISTRIBUTION LIST PPPO-01-1927046-13B

Dear Sirs/Madams:

SITEWIDE ENVIRONMENTAL ASSESSMENT AT THE PADUCAH GASEOUS DIFFUSION PLANT

The U.S. Department of Energy (DOE) is considering the potential conveyance (lease, easement, and/or title transfer) for economic development and/or recreation, of a portion of DOE's real property at the Paducah Gaseous Diffusion Plant (PGDP). If such transfers prove feasible, DOE could effectuate title transfers, leases and/or easements, with such entities as the Paducah-Area Community Reuse Organization, the Commonwealth of Kentucky, local governments, or private entities.

DOE's potential action is designed to reduce the footprint of the site and the eventual cost for maintenance of the site. The conveyance of excess DOE property also could offset economic losses for the community resulting from continued DOE downsizing, and facility workforce restructuring.

The PGDP is located in a generally rural area of McCracken County in western Kentucky, approximately 3.5 miles south of the Ohio River and over 10 miles west of the city of Paducah (Figure 1). The current size of the DOE's Paducah reservation is 3,556 acres of which approximately 650 acres are within the fenced security area and another 1,986 acres are part of the West Kentucky Wildlife Management Area (Figure 2).

An Environmental Assessment (EA) is currently being prepared for the potential property transfer(s) action by DOE's Portsmouth/Paducah Project Office to meet the requirements of the National Environmental Policy Act (NEPA). While no transfers are currently planned, DOE is evaluating environmental impacts of potential land transfers to aid DOE in its future decision making. As part of this process, DOE is inviting Native American groups with historical ties to the area under consideration to participate in the NEPA process. As such, DOE is seeking any comments or concerns you have on the potential for this proposed action to affect those properties or other resources significant to the tribe. When it becomes available, DOE will provide you with a copy of the draft EA so that you can raise any specific concerns you may have.

This information is being requested to aid in the preparation of the EA. Any information you provide regarding specific cultural resources will remain confidential as stipulated in 36 Code of Federal Regulations Part 800.11. Once the Draft EA is available, we welcome your comments and input. If you have any questions or require additional information please contact Buz Smith of my team at (270) 441-6821, or if you have any questions or comments about the project, please contact as soon as possible at the following:

Pete J. Yerace
Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, KY 40513
Email: pete.yerace@emcbc.doe.gov
Phone: 513-246-0528

Thank you in advance for your consideration.

Sincerely,

William E. Murphie
Manager
Portsmouth/Paducah Project Office

Enclosures:
Figure 1. Location of the PGDP Site
Figure 2. Aerial photograph of the PGDP site and immediate vicinity

cc w/enclosures:
cynthia.zvonar@lex.doe.gov, PPPO/LEX
laura.roenker@lex.doe.gov, PPPO/LEX
lisa.santoro@lex.doe.gov, PPPO/PAD
pete.yerace@emcbc.doe.gov, EMCBC
rachel.blumenfeld@lex.doe.gov, PPPO/PAD
robert.edwards@lex.doe.gov, PPPO/LEX
robert.smith@lex.doe.gov, PPPO/PAD

DISTRIBUTION LIST 3 PPPO-01-1927046-13B

DISTRIBUTION LIST

Mr. Bill John Baker, Principal Chief
Cherokee Nation
P.O. Box 948
Tahlequah, OK 74465

Mr. Richard Allen
NAGPRA/Section 106 Contact
Cherokee Nation
P.O. Box 948
Tahlequah, OK 74465

Ms. Glenna J. Wallace, Chief
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865

Ms. Robin Dushane
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865

Mr. Michell Hicks, Principal Chief
Eastern Band of Cherokee Indians
P.O. Box 455
Cherokee, NC 28719

Ms. Betty Moreland
Environmental and Natural Resources Office
Eastern Band of Cherokee Indians
P.O. Box 455
Cherokee, NC 28719

Mr. George Wickliffe, Chief
United Keetoowah Band of Cherokee Indians
P.O. Box 746
Tahlequah, OK 74465

Ms. Lisa Baker
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee Indians
P.O. Box 746
Tahlequah, OK 74465

Mr. Ron Sparkman, Chief
Shawnee Tribe
P.O. Box 189
Miami, OK 74355

Ms. Kim Jumper
Tribal Historic Preservation Officer
Shawnee Tribe
P.O. Box 189
Miami, OK 74355

Mr. George Blanchard, Governor
Absentee Shawnee Tribe of Indians of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, OK 74801

Mr. Joseph Blanchard
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Indians of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, OK 74801

Mr. Thomas E. Gamble, Chief
Miami Tribe of Oklahoma
PO Box 1326
Miami, OK 74355

Mr George Strack
Tribal Historic Preservation Officer
Miami Tribe of Oklahoma
PO Box 1326
Miami, OK 74355

Mr. John P. Froman, Chief
Peoria Indian Tribe of Oklahoma
P.O. Box 1527
Miami, OK 74355
918-540-2535

Mr. Frank Hecksher
NAGPRA and Special Projects Manager
Peoria Indian Tribe of Oklahoma
P.O. Box 1527
Miami, OK 74355

DISTRIBUTION LIST 4 PPPO-01-1927046-13B

DISTRIBUTION LIST CONTINUED

Mr. Bill Anotatubby, Governor
Chickasaw Nation
P.O. Box 1548
Ada, Oklahoma 74821

Ms. LaDonna Brown
Tribal Historic Preservation Officer
Chickasaw Nation
P.O. Box 1548
Ada, OK 74821-1548

Mr. John Berrey, Chairman
Quapaw Tribe of Indians
P.O. Box 765
Quapaw, OK 74363

Ms. Jean Ann Lambert
Tribal Historic Preservation Officer
Quapaw Tribe of Indians
P.O. Box 765
Quapaw, OK 74363

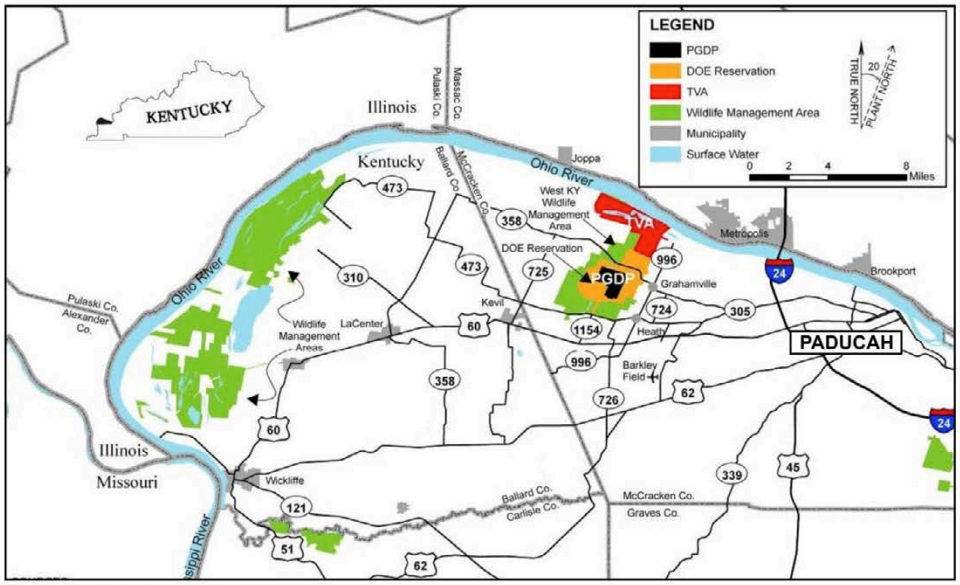


Figure 1. Location of the PGDP site


Figure 2. Aerial photograph of the PGDP site and immediate vicinity

ᏣᎳᎩ ᎠᏰᎵ
CHEROKEE NATION®
P.O. Box 948 • Tahlequah, OK 74465-0948 • 918-453-5000 • cherokee.org

Office of the Chief

Bill John Baker
Principal Chief
ᏫᎵ ᏣᏂ ᏗᎦᎦᏬᏍᎩ
ᎤᎬᏫᏳᎯ

S. Joe Crittenden
Deputy Principal Chief
Ꮝ. ᏦᏩ ᏗᎬᎩᏍᎩ
ᏔᎵᏁ ᎠᏓᏅᏁ ᎤᎬᏫᏳᎯ

RECEIVED AUG 0 8 2013 BY:

15 July 2013

Pete Yerace
Department of Energy
Portsmouth/Paducah Project Office
1017 Majestic Dr., Suite 200
Lexington, KY 40513

re: Paducah Gaseous Diffusion Plant

Mr. Yerace:

The Cherokee Nation appreciates the opportunity to comment upon the **Paducah Gaseous Diffusion Plant** project. The Cherokee Nation does not currently maintain records of cultural resources in this geographic area. Thus, we would request you conduct your inquiry with the Eastern Band of Cherokee Tribal Historic Preservation Office. However, if during the conduct of the project, items of cultural significance are discovered, the Cherokee Nation requests you recontact our offices for further consultation. If you have any questions or require further information, please contact Mr. Pat Gwin, Administration Liaison, at 918/453-5704.
Thank you.

Sincerely,

Pat Gwin

CONVERSION FACTORS

Metric to English			English to Metric		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area					
square kilometers	247.1	acres	acres	0.0040469	square kilometers
square kilometers	0.3861	square miles	square miles	2.59	square kilometers
square meters	10.764	square feet	square feet	0.092903	square meters
Concentration					
kilograms/square meter	0.16667	tons/acre	tons/acre	0.5999	kilograms/square meter
milligrams/liter	1[a]	parts/million	parts/million	1[a]	milligrams/liter
micrograms/liter	1[a]	parts/billion	parts/billion	1[a]	micrograms/liter
micrograms/cubic meter	1[a]	parts/trillion	parts/trillion	1[a]	micrograms/cubic meter
Density			pounds/cubic feet	0.016018	grams/cubic centimeter
grams/cubic centimeter	62.428	pounds/cubic feet	pounds/cubic feet	16,025.6	grams/cubic meter
grams/cubic meter	0.0000624	pounds/cubic feet			
Length			inches	2.54	centimeters
centimeters	0.3937	inches	feet	0.3048	meters
meters	3.2808	feet	inches	25,400	micrometers
micrometers	0.00003937	inches	inches	25.40	millimeters
millimeters	0.03937	inches	miles	1.6093	kilometers
kilometers	0.62137	miles			
Temperature					
Absolute			degrees Fahrenheit−32	0.55556	degrees Celsius
degrees Celsius × 1.8	+32	degrees Fahrenheit			
Relative			degrees Fahrenheit	0.55556	degrees Celsius
degrees Celsius	1.8	degrees Fahrenheit			
Velocity or Rate			cubic feet/minute	0.00047195	cubic meters/second
cubic meters/second	2,118.9	cubic feet/minute	miles/hour	0.44704	meters/second
meters/second	2.237	miles/hour			
Volume			gallons	0.0037854	cubic meters
cubic meters	264.17	gallons	cubic feet	0.028317	cubic meters
cubic meters	35.314	cubic feet	cubic yards	0.76456	cubic meters
cubic meters	1.3079	cubic yards	acre-feet	1,233.49	cubic meters
cubic meters	0.0008107	acre-feet	gallons	3.78533	liters
liters	0.26418	gallons	cubic feet	28.316	liters
liters	0.035316	cubic feet	cubic yards	764.54	liters
liters	0.001308	cubic yards			
Weight/Mass			ounces	28.35	grams
grams	0.035274	ounces	pounds	0.45359	kilograms
kilograms	2.2046	pounds	tons (short)	907.18	kilograms
kilograms	0.0011023	tons (short)	tons (short)	0.90718	metric tons
metric tons	1.1023	tons (short)			
English to English					
acre-feet	325,850.7	gallons	gallons	0.000003046	acre-feet
acres	43,560	square feet	square feet	0.000022957	acres
square miles	640	acres	acres	0.0015625	square miles

a. This conversion factor is only valid for concentrations of contaminants (or other materials) in water.

METRIC PREFIXES

Prefix	Symbol	Multiplication factor		Scientific notation
tera-	T	1,000,000,000,000	=	1×10^{12}
giga-	G	1,000,000,000	=	1×10^{9}
mega-	M	1,000,000	=	1×10^{6}
kilo-	k	1,000	=	1×10^{3}
deca-	D	10	=	1×10^{1}
deci-	d	0.1	=	1×10^{-1}
centi-	c	0.01	=	1×10^{-2}
milli-	m	0.001	=	1×10^{-3}
micro-	μ	0.000001	=	1×10^{-6}
nano-	n	0.000000001	=	1×10^{-9}
pico-	p	0.000000000001	=	1×10^{-12}