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U.S. Department of Energy

Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project Final Environmental Impact Statement

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COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Title: Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project Final Environmental Impact Statement (EIS) (DOE/EIS-0318)

Location: Clark County, Kentucky

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Abstract: The Kentucky Pioneer IGCC Demonstration Project Final EIS assesses the potential environmental impacts that would result from a proposed DOE action to provide cost-shared financial support for construction and operation of an electrical power station demonstrating use of a Clean Coal Technology in Clark County, Kentucky. Under the Proposed Action, DOE would provide financial assistance, through a Cooperative Agreement with Kentucky Pioneer Energy, LLC, for design, construction, and operation of a 540 megawatt demonstration power station comprised of two synthesis gas-fired combined cycle units in Clark County, Kentucky. The station would also be comprised of a British Gas Lurgi (BGL) gasifier to produce synthesis gas from a co-feed of coal and refuse-derived fuel pellets. The facility would be powered by the synthesis gas feed. The proposed project would consist of the following major components: (1) refuse-derived fuel pellets and coal receipt and storage facilities; (2) a gasification plant; (3) sulfur removal and recovery facilities; (4) an air separation plant; and (5) two combined cycle generation units. The IGCC facility would be built to provide needed power capacity to central and eastern Kentucky. At a minimum, 50 percent of the high-sulfur coal used would be from the Kentucky region. Two No Action Alternatives are analyzed in the Final EIS. Under No Action Alternative 1, DOE would not provide cost-shared funding for construction and operation of the proposed facility and no new facility would be built. Under No Action Alternative 2, DOE would not provide any funding and, instead of the proposed demonstration project, Kentucky Pioneer Energy, LLC, would construct and operate, a 540 megawatt natural gas-fired power station.

Evaluation of potential impacts on land use, socioeconomics, cultural resources, aesthetic and scenic resources, geology, air resources, water resources, ecological resources, noise, traffic and transportation, occupational and public health and safety, and environmental justice are included in the assessment.

Public Comments: The public comment period on the Draft EIS was held from November 16, 2001, to January 25, 2002. During the comment period, public hearings were in held in Lexington and Trapp, Kentucky. The Draft EIS was made available through mailings and through requests to DOE. In preparing the Final EIS, DOE considered comments received by U.S. mail, electronic mail, fax, telephone and through written and verbal comments submitted at the public meetings.

The Final EIS contains revisions and additions in response to comments submitted after the issuance of the Draft EIS and additional technical details not available at the time of issuance of the Draft EIS. The revisions and additions made since the issuance of the Draft EIS are underscored. Appendix D, Comment Response Document, of the Final EIS contains the comments received during the public review of the Draft EIS and DOE responses to those comments.

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ACRONYMS AND ABBREVIATIONS

^{O}C	degrees Celcius
^{O}F	degrees Farenheit
BEA	U.S. Bureau of Economic Analysis
BGL	British Gas Lurgi
CAA	*Clean Air Act*
CCT	Clean Coal Technology
CCT PEIS	*Clean Coal Technology Programmatic Environmental Impact Statement*
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COS	carbonyl sulfide
CT	combustion turbine
dB	decibel
dBA	"A-weighted" decibel
dBC	"C-weighted" decibel
DOE	U.S. Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EIV	environmental information volume
EKPC	East Kentucky Power Cooperative
EMF	electric and magnetic fields
EPA	U.S. Environmental Protection Agency
EPCRA	*Emergency Planning and Community Right-to-Know Act*
ER	Environmental Report
FAA	Federal Aviation Administration
FONSI	finding of no significant impact
FR	*Federal Register*
GE	General Electric
H_2	hydrogen gas
H_2S	hydrogen sulfide
IGCC	integrated gasification combined cycle
J.K. Smith EIS	*Final Environmental Impact Statement J.K. Smith Power Station Units 1 and 2*
KAR	Kentucky Administrative Regulations
KDEP	Kentucky Department of Environmental Protection
KHC	Kentucky Heritage Council
KPDES	Kentucky Pollutant Discharge Elimination System
KPE	Kentucky Pioneer Energy, L.L.C.
KRS	Kentucky Revised Statutes
kV	kilovolt
L_{dn}	day-night average sound level
L_{eq}	equivalent noise levels
mG	milligauss
MGD	million gallons per day
MLD	million liters per day
MM	Modified Mercalli Index
MP	milepost
MSW	Municipal Solid Waste
MW	megawatt
N_2	nitrogen gas
NAAQS	National Ambient Air Quality Standards
NAGPRA	*Native American Graves Protection and Repatriation Act*
NEPA	*National Environmental Policy Act*

NESHAP	National Emission Standards for Hazardous Air Pollutant
NHPA	*National Historic Preservation Act*
NIEHS	National Institute of Environmental Health Services
NOI	Notice of Intent
NO_x	oxides of nitrogen
NPDES	*National Pollutant Discharge Elimination System*
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
O_2	oxygen gas
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
$PM_{2.5}$	fine particlulate matter
PM_{10}	inhalable particulate matter
PPM	parts per million
PSD	prevention of significant deterioration
psig	pounds per square inch-gauge
RCRA	*Resource Conservation and Recovery Act*
RDF	refuse derived fuel
REA	Rural Electrification Agency
ROD	Record of Decision
ROG	reactive organic compounds
ROI	region of influence
RUS	U.S. Department of Agriculture's Rural Utility Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPCC	Spill Prevention, Control, and Countermeasure
syngas	synthesis gas
TCLP	Toxicity Characteristic Leaching Procedure
TCP	Traditional Cultural Property
TPD	tons per day
TPY	tons per year
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

UNITS CONVERSION GUIDE

To Convert Into Metric			To Convert Into English		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile (Statute)
Area					
square inch	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
long ton	1.016	metric ton	metric ton	0.9843	long ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The abundance of coal in the United States makes it one of our Nation's most important strategic resources in building a secure energy future. With today's prices and technology, recoverable reserves located in the United States could supply the Nation's coal consumption for at least 250 years at current usage rates. However, if coal is to reach its full potential as an environmentally acceptable source of energy, an expanded menu of advanced clean coal technologies must be developed to provide substantially improved options both for the consumer and private industry.

Before any technology can be seriously considered for commercialization, it must be demonstrated at a sufficiently large scale to develop industry confidence in its technical and economic feasibility. The implementation of a federal technology demonstration program is the established means of accelerating the development of technology to meet national energy strategy and environmental policy goals, to reduce the risk to human health and the environment to an acceptable level, to accelerate commercialization and to provide the incentives required for continued activity in research and development directed at providing solutions to long-range energy problems.

This environmental impact statement (EIS) has been prepared by the U.S. Department of Energy (DOE) in compliance with the *National Environmental Policy Act* of 1969 (NEPA) as amended (42 United States Code [USC] 4321 et seq.), to evaluate the potential impacts associated with constructing and operating a project proposed by Kentucky Pioneer Energy, LLC (KPE), a subsidiary of Global Energy, Inc. The project has been selected for further consideration by DOE under the Clean Coal Technology (CCT) Program to demonstrate the first commercial-scale application of a modified version of the British Gas Lurgi (BGL) gasification technology in the United States, with the goal of developing a cleaner method of utilizing coal for electricity generation. The modification to the BGL technology that would be demonstrated by this project involves the fuel feed to the facility. This project would demonstrate the ability to run BGL gasification technology from a co-feed of coal and refuse derived fuel (RDF) pellets. The facility would also generate between 40 and 50 percent more capacity than other BGL facilities currently in operation. Though BGL technology is a proven means of generating electricity, this project would be the first commercial application of this particular modification to the process, along with the size of the output at which the facility would operate. DOE's role in this project is to make a decision on whether or not to provide cost-shared funding to design, construct, and demonstrate the BGL technology proposed by KPE at the J.K. Smith Site in Clark County, Kentucky.

1.2 Background

Since the early 1970s, DOE and its predecessor agencies have pursued a broadly-based coal research and development program directed toward increasing the Nation's opportunities to use its most abundant fossil energy resource while improving environmental quality. This research and development program includes long-term projects that support the development of innovative concepts for a wide variety of coal technologies. The CCT Program was implemented to allow a number of advanced, more efficient, and environmentally responsible coal utilization and environmental control technologies to become available to the U.S. energy marketplace.

The CCT Program began in 1986 as a collaboration between federal and state governments and industry representatives to develop environmentally-friendly solutions for the utilization of the Nation's abundant coal resources. The Program's goal is to demonstrate innovative technologies emerging from global engineering laboratories at a scale large enough so that the industry could determine whether the new processes had commercial merit.

Originally, the CCT Program was a response to concerns over acid rain, which is formed by sulfur and nitrogen pollutants emitted by coal-burning power plants. President Reagan, through consultation with various agencies, commissioned the CCT Program as a cost-shared effort between the U.S. Government, State agencies, and the private sector. Industry-proposed projects were selected through a series of five national competitions aimed at attracting promising technologies that had not yet been proven commercially.

DOE issued the first solicitation (CCT-I) for CCT projects in 1986. This solicitation resulted in a broad range of projects being selected in the following four major product markets: environmental control devices; advanced electric power generation; coal processing for clean fuels; and industrial applications.

In 1987, the CCT Program became the centerpiece for satisfying the recommendations contained in the *Joint Report of the Special Envoys on Acid Rain*. A presidential initiative launched a 5-year, $5 billion U.S. Government/industry effort to curb precursors to acid rain formation. The second solicitation (CCT-II), issued in February 1988, provided for the demonstration of technologies that were capable of achieving significant reductions in sulfur dioxide (SO_2) , nitrogen oxides (NO_x), or both, from existing power plants. These technologies were to be more cost-effective than current technologies and capable of commercial deployment in the 1990s. In May 1989, DOE issued a third solicitation (CCT-III) with essentially the same objective as the second, but additionally encouraged technologies that would produce clean fuels from run-of-mine coal.

The next two solicitations recognized emerging energy and environmental issues, such as global climate change and capping of SO_2 emissions, and thus focused on seeking highly efficient, economically competitive, and low-emission technologies. Specifically, the fourth solicitation (CCT-IV), released in January 1991, had as its objective the demonstration of energy-efficient, economically competitive technologies capable of retrofitting, repowering, or replacing existing facilities while achieving significant reductions in SO_2 and NO_x emissions. In July 1992, DOE issued the fifth and final solicitation (CCT-V) to provide for demonstration projects that significantly advanced the efficiency and environmental performance of technologies applicable to new or existing facilities. As a result of these five solicitations, a total of 60 government/industry cost-shared projects were selected, of which 38, valued at more than $5.2 billion, have either been successfully completed or remain active in the CCT Program.

The Kentucky Pioneer IGCC Demonstration Project was selected for further consideration under the fifth solicitation (CCT-V) authorized under Public Law 102-154. The CCT Program relies on substantial funding from sources other than the federal government as the participant supports the majority of the project cost. The *Department of the Interior and Related Agencies Appropriations Act* of 1986, a section of Public Law 99-190, introduced and defined cost sharing for the program. The participant must agree to repay the government's financial contribution, with the basis for the repayment negotiated between the participant and the government, to ensure that taxpayers benefit from a successful project. Congress has directed that projects in the CCT Program should be industry projects assisted by the government and not government-directed demonstrations.

DOE selected for further consideration the Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project, which KPE will own and operate. The objective of the proposed Kentucky Pioneer IGCC Demonstration Project would be the demonstration of the first commercial fixed-bed co-fed BGL process in the United States. The project would demonstrate repowering and retrofit technologies by incorporating coal gasification technology into the IGCC process.

DOE developed an overall NEPA strategy for the CCT Program that includes consideration of both programmatic and project-specific environmental impacts during and after the selection process of the proposed project site. As part of the NEPA strategy, the EIS for the Kentucky Pioneer IGCC Demonstration Project tiers from the *Clean Coal Technology Programmatic Environmental Impact Statement* (CCT PEIS) that DOE issued in November 1989 (DOE/EIS-0146). The CCT PEIS evaluated two alternatives, the No Action Alternative, and the Proposed Action. The No Action Alternative assumed the CCT Program would

not continue and that conventional coal-fired technologies with flue gas desulfurization and nitrogen oxide controls that met New Source Performance Standards (NSPS) would continue to be used. The NSPS (40 *Code of Federal Regulations* [CFR] 60) were established under the 1970 amendments to the *Clean Air Act* to adopt emission standards for major new industrial facilities. The Proposed Action assumed that the clean coal projects would be selected and funded, and that successfully demonstrated technologies would undergo widespread commercialization by the year 2010.

Under the CCT Program and NEPA, DOE is responsible for a comprehensive review of reasonable alternatives for siting the proposed project. However, in dealing with the applicant or industrial partner, the scope of alternatives is necessarily more restricted because DOE must focus on alternative ways to accomplish its purpose that reflects both the application before the Department and the functions DOE plays in the decision process. DOE's role is limited because the federal government is neither the owner nor operator of the proposed project. It is appropriate in such cases for DOE to give substantial consideration to the applicant's needs in establishing a project's reasonable alternatives.

The range of reasonable alternatives to be considered in the EIS for the proposed Kentucky Pioneer IGCC Demonstration Project is determined in accordance with the overall NEPA strategy. In a Cooperative Agreement with an applicant, the scope of alternatives is necessarily more restricted so that DOE can focus on alternative ways to accomplish the programmatic goals based on the specific application being considered for funding. The EIS includes analysis of the No Action Alternative, as required under NEPA, and the Proposed Action. Since KPE has stated that the site would be used to construct a natural gas-fired combined-cycle plant should DOE decide against providing cost-shared funding for the gasification technology demonstration, two No Action Alternatives are addressed. No Action Alternative 1 assumes that DOE decides against providing cost-shared funding for the project and that no plant is constructed as a result. This will essentially result in no effects to the existing environment. As shown previously, this is unlikely to occur but it is presented because it serves as an analytical baseline for comparison of the environmental effects of the project.

No Action Alternative 2 assumes that DOE decides against providing cost-shared funding for the project and KPE constructs a natural gas-fired combined-cycle plant, the power island portion of the overall project, at the proposed project location. The changes in the environment resulting from the operation of the combined cycle turbines are presented in the appropriate sections of Chapter 5, Environmental Impacts, and are used as a basis to compare the impacts of the Proposed Action.

DOE does not plan to evaluate alternative sites for the proposed project due to DOE's limited role in providing cost-shared funding for the project and the applicant's intention to proceed with the construction of the natural gas-fired combined-cycle plant at the partially constructed J.K. Smith Site, even if DOE decides not to provide cost-shared funding.

1.3 The Proposed Kentucky Pioneer IGCC Demonstration Project

The Proposed Action is for DOE to provide financial assistance through a Cooperative Agreement with KPE, a subsidiary of Global Energy, Inc., for the design, construction and operation of the proposed project in Clark County, Kentucky. DOE's Cooperative Agreement with KPE was originally based on the construction and operation of a 400 megawatt (MW) IGCC power plant. The 400 MW output was based on the commercial availability of the new General Electric (GE) 7H gas turbine technology. This would have included one 270 MW gas turbine and one 130 MW steam turbine for the combined cycle configuration. However, the GE 7H would not be available in a timeframe that supports the Kentucky Pioneer IGCC Demonstration Project. Therefore, KPE decided to utilize the currently available GE 7FA technology. Two GE 7FA gas turbines produce approximately 400 MW in one simple cycle. With the addition of a steam turbine to the two GE 7FA gas turbines, the net output of the combined cycle power unit would increase to

540 MW. Due to the equipment change since the issuance of the Cooperative Agreement, the analyses in this EIS will be based on a combined cycle net power output of 540 MW instead of 400 MW (Global Energy 2000b).

Since the issuance of the Notice of Intent (NOI), the solid fuel source for this project has changed from fuel briquettes made from high-sulfur coal and municipal solid waste (MSW) to co-feeding coal and RDF pellets. RDF pellets are generated from refined MSW. During the pellet production process, large objects and contaminants are removed and the remaining waste is milled into a mulch and pressed into pellets. The process is described in greater detail in Section 3.2.2.2, Refuse Derived Fuel Pellet Production. RDF pellets would be procured from an existing RDF pellet manufacturer. The two fuel sources would be shipped by rail directly to on-site storage. At least 50 percent of the co-feed would consist of high-sulfur coal from the Kentucky region. KPE changed the solid fuel source due to the simplicity and cost effectiveness of co-feeding the two components (Global Energy 2000b).

The facility would demonstrate the following innovative technologies: (1) gasification of a blend of coal and RDF pellets using the BGL process; and (2) the utilization of a synthesis gas (syngas) product as a clean fuel in combined cycle turbine generator sets. The demonstration would operate for a minimum of the first year of the facility's 20-year commercial operation period. Data generated during the 1-year demonstration would be used to determine if the coal and RDF pellet co-feed would continue after the first year of operation.

As originally proposed, the project included a high temperature molten carbonate fuel cell. However, in July 2002, DOE decided to move the fuel cell demonstration portion of the Kentucky Pioneer IGCC Demonstration Project to Global Energy's Wabash River IGCC plant near West Terre Haute, Indiana. By utilizing an already existing commercial IGCC plant with experienced personnel, this re-siting would advance the projected fuel cell demonstration schedule by more than 1 year, thereby providing potential for the technology to enter the market at an earlier date. Accordingly, the fuel cell is no longer considered a part of the Proposed Action and subsequent discussion and analysis related to the fuel cell has been removed in this Final EIS. Without the fuel cell component, DOE's cost-share amount for the KPE project would be $60 million. The fuel cell demonstration has independent utility, and DOE will determine whether to proceed with the fuel cell demonstration separate from its decisionmaking regarding the Proposed Action. As appropriate DOE will undertake separate NEPA analysis with regard to the re-siting of the fuel cell.

The proposed project would consist of the following major facility components: (1) RDF pellet and coal receipt and storage sheds; (2) gasification plant; (3) sulfur removal and recovery facility; (4) air separation plant; and (5) two combined cycle electric generation units. The production of syngas in the BGL process occurs in the gasification plant, sulfur removal and recovery facility, and air separation plant.

Under the Proposed Action, the two GE 7FA gas turbines would be fired with syngas. The syngas firing process consists of the following four steps: (1) generation of syngas from RDF pellets and coal reacting with steam and oxygen in a high-temperature reducing atmosphere; (2) removal of contaminants, including particulates and sulfur in the sulfur removal and recovery facility; (3) clean syngas combustion in a gas turbine generator to produce electricity; and (4) recovery of residual heat in the hot gas produced by the gas turbine. This residual heat is then used to generate steam in a heat recovery steam generator that produces additional electricity in a steam turbine, which is the combined cycle aspect of the plant.

The project is located in Clark County, Kentucky. The project site is located on approximately 121 hectares (300 acres) within a 1,263-hectare (3,120-acre) tract owned by East Kentucky Power Cooperative (EKPC). The tract is 34 kilometers (21 miles) southeast of the city of Lexington, 13 kilometers (8 miles) southeast of the city of Winchester, and 1.6 kilometers (1 mile) west of the Trapp community.

The proposed location was originally slated for a conventional coal-fired power plant in the early 1980s when demand for electricity was forecasted to significantly increase. The 121 hectares (300 acres)

were previously disturbed in the 1980s after the issuance of a Record of Decision (ROD) by the Rural Electrification Agency (REA) for the *Final Environmental Impact Statement J.K. Smith Power Station Units 1 and 2* (J.K. Smith EIS). When the demand for additional electricity failed to materialize, the construction on that project was halted. Preliminary grading, primary foundations, fire protection piping, and access infrastructure installation were completed in the project site area. KPE has stated that it intends to construct the combined cycle power unit (power island) at this site regardless of the outcome of the demonstration project application.

1.4 Relationship of the Environmental Impact Statement to Other *National Environmental Policy Act* Documents

The following discussion provides a brief summary of the NEPA documents issued to date that relate to the project or site area.

The *Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project Environmental Impact Statement* will tier from the CCT PEIS that was issued by DOE in November 1989 (DOE/EIS-0146). The CCT PEIS evaluated two alternatives: (1) the No Action Alternative, which assumed the CCT Program would not continue, and that conventional coal fired technologies with flue gas desulfurization and nitrogen oxide controls that met NSPS would continue to be used; and (2) the Proposed Action, which assumed that the clean coal projects would be selected and funded. The CCT PEIS Proposed Action assumed that successfully demonstrated technologies would undergo widespread commercialization by the year 2010.

The J.K. Smith EIS was issued by REA in 1980. The EIS describes the environmental effects of the construction and operation of two 650 MW coal-fired steam electric generating units and the associated 345 kilovolt (kV), 161 kV, and 138 kV transmission lines. The U.S. Department of Agriculture's Rural Utility Service's ROD for the J.K. Smith EIS stated that there would be no significant impacts for project implementation. The J.K. Smith EIS was used as a source document to prepare Chapter 4, Affected Environment, of the Kentucky Pioneer IGCC Demonstration Project EIS. Where necessary, updated information was included and documented accordingly.

The following documents were also reviewed in preparation of this EIS:

- *Environmental Analysis, J.K. Smith Power Station Units 1 and 2, Clark County, Kentucky.* This document was prepared by REA in 1979 and revised in 1980 to analyze the impacts of the proposed J.K. Smith Power Station, and represents an initial step in assessing the potential environmental impacts associated with the conceptual design and in estimating quantitative design information for the J.K. Smith Power Station. The proposed generation station would have had two electric generating units each containing a coal-fired boiler and a steam driven turbine generator. A Finding of No Significant Impact (FONSI) was issued by REA with respect to the potential environmental impacts resulting from the proposed project.

- *Environmental Assessment, Combustion Turbine Generation Project.* This environmental assessment (EA) was prepared in June 1992 by East Kentucky Power Cooperative's (EKPC) to analyze the construction and operation of three simple cycle combustion turbine generating units at a site within EKPC service territory. Alternatives considered included the No Action Alternative, demand side options, purchased capacity from both utility and non-utility generators, and ownership participation in a coal-fired unit. In addition, alternative generation technologies and alternative sites were evaluated. The J.K. Smith Site and the Columbia Site were both evaluated as potential siting locations within the EKPC service area. A FONSI was issued by the REA with respect to the potential environmental impacts resulting from the proposed project.

1.5 Public Participation

To date, public participation for the EIS has consisted of the scoping process, which included a public comment period, during which one public scoping meeting was held; and the public comment process which included a public comment period, during which two public meetings were held.

1.5.1 Public Scoping Process

Upon publishing an NOI in the *Federal Register* (FR) announcing its intent to prepare an EIS for the Kentucky Pioneer IGCC Demonstration Project (65 FR 20142), DOE notified interested persons, including federal, state, and local government agencies, public interest groups, regulators, and members of the general public and invited them to participate in the scoping process (see Appendix B). Publication of the NOI marked the beginning of the formal public scoping period for the Kentucky Pioneer IGCC Demonstration Project EIS. DOE held a public scoping meeting in Trapp, Kentucky, on May 4, 2000, to allow interested parties to present verbal and written comments. In addition, an informal session prior to the scoping meeting was held on May 4, 2000, from 4:00 p.m. to 6:00 p.m., at the Trapp Elementary School in Trapp, Kentucky. The formal scoping meeting was held from 7:00 p.m. to 9:00 p.m. following the informal session. The scoping period officially closed on May 31, 2000.

To encourage broad public participation, DOE notified stakeholders by mail, prior to the public scoping meeting. In addition, press releases and public service announcements were submitted to selected newspapers. Informational handouts and factsheets were distributed widely at the scoping meeting and by request.

Thirty-six individuals signed in at the scoping meeting, at which 5 participants provided a total of 19 verbal comments. Three individuals submitted eight written comments during the public comment period.

State agency representatives, members of interested groups, and private individuals attended the public scoping meeting and submitted comments on the scope of the EIS. The following attendees signed in at the meeting:

- Current DOE employees
- Contractor representatives
- Global Energy, Inc., representatives
- EKPC representatives
- Elementary school representatives (i.e. superintendent, principal)
- Media personnel
- Union members
- Community members

1.5.2 Summary of Issues/Concerns Raised During the Public Scoping Process

For purposes of tracking and analysis, all comments received were categorized and organized into a database. The categories of comments received are summarized below. As appropriate, DOE took comments provided at the scoping meeting into consideration in preparing the EIS. The following is a brief summary of comments presented by members of the public at the public scoping meeting of May 4, 2000. The comments have been organized according to resource areas analyzed in this document.

Commentors asked many questions regarding the local market and economy throughout the term of the proposed project. Some commentors were concerned with the number of local and union representatives that would be hired during construction and plant operations. In addition, these commentors stated that union labor continues to be the most productive, competent, and skilled workforce worldwide. Issues related to socioeconomics can be found in Section 4.3 and 5.3, Socioeconomics.

One commentor stated that housing would be an issue associated with the project. In addition, another commentor wanted to know how many children would be entering into the local school district and into the surrounding community once the project construction commences. These issues are analyzed in Section 4.3 and 5.3, Socioeconomics.

One commentor asked what consumer savings have been experienced from previous plants. To date, this issue has not been addressed as part of this EIS because DOE believes that it is not within the scope.

One commentor stated that visual resources and land use impacts should be addressed in the EIS since the site is off the main highway. Land use impacts have been addressed in Section 5.2, Land Use. In addition, visual impacts have been analyzed in Section 5.5, Aesthetic and Scenic Resources.

Commentors raised issues regarding air pollution emissions associated with the proposed project. In addition, one commentor indicated that air and water quality are very well regulated. Air and water resources have been analyzed in Section 5.7, Air Resources, and Section 5.8, Water Resources and Water Quality.

Commentors stated that they believe noise will be an issue associated with the project. One commentor indicated that a significant noise problem may interfere with the running of the local school, which is located one mile away from the proposed project location. Noise impacts have been analyzed in Section 5.10, Noise.

Multiple comments were received regarding traffic and transportation issues. Commentors are concerned about the infrastructure of the community roads, the amount of traffic during working hours, and the provisions and regulations required to keep traffic under control in the surrounding area. Commentors also asked whether the primary mode of transportation would be truck or rail transportation. One commentor believes that there is going to be a transportation processing problem before the briquettes arrive at the site. Impacts from traffic and transportation have been analyzed in Section 5.11, Traffic and Transportation.

One commentor stated that they believe environmental justice concerns should be addressed in the EIS. Environmental justice issues have been addressed in Section 5.19, Environmental Justice.

Commentors stated their concerns relating to the briquettes and the briquette facility location. Commentors inquired if the material would be coming from local sources to produce the briquettes. One commentor indicated that the briquettes should be manufactured close to the site. Another commentor asked how closely the 50 percent of MSW would be monitored. In addition, one commentor wanted to know information about the logistics of integrating the garbage and integrating the high-sulfur coal. One commentor asked if the source of the waste would be in Clark County or another location. In addition, the commentor asked if the solid waste would be picked up for free or would the local community have to dispose of it if the solid waste came from a local source. Another commentor asked if the waste generated at the facility would be landfilled in the area or away from the area. Finally, another commentor asked if the material generated onsite would be stockpiled on site or be transported to an off-site location. A discussion of the fuel sources is presented in Section 3.2, Fuel Source. Briquettes are no longer the proposed fuel source for this project.

One commentor stated that they hope the facility is built with justice and dignity of the taxpayers' money.

1.5.3 Public Comment Process on the Draft Environmental Impact Statement

On November 16, 2001, DOE published the Notice of Availability for the Kentucky Pioneer IGCC Demonstration Project Draft EIS in the FR (66 FR 57717). The original comment period for the Draft EIS would have ended on January 4, 2002; however, to accommodate requests from the public, the public comment period on the Draft EIS was extended to January 25, 2002. The total comment period was 71 days.

Public meetings were held on December 10, 2001, in Lexington, Kentucky, and on December 11, 2001, in Trapp, Kentucky. In addition, the public was encouraged to provide comments via mail, electronic mail, fax, telephone, and through written and verbal comments submitted at the public meetings. A court reporter was present at the public meetings to provide a verbatim transcript of the proceedings and record any formal comments. DOE considered and responded to all of the comments received on the Draft EIS.

Appendix D of this EIS, the Comment Response Document, describes the public comment process in detail and provides copies of all comments received and DOE's response to each comment. Altogether, DOE received 38 comment documents containing 373 comments. Responses to these comments and corresponding changes to the Draft EIS helped to improve the quality and usefulness of the Final EIS. Among the topics or issues raised in the comments were concerns about:

- the applicability of and compliance with state and local solid waste statutes
- the detail of the facility and BGL process description
- the potential of the vitreous frit to be hazardous and related waste management issues
- the need for power in central Kentucky
- the impacts of the related transmission line
- impacts to the Kentucky River
- impacts of plant operation on air resources, including acid rain and greenhouse gases
- impacts of facility discharges on local drinking water
- impacts of air emissions from the facility
- the handling of materials and waste to reduce impacts from potential spills
- impacts to the aesthetic and scenic resources of the area
- impacts to Kentucky Highway 89 and local traffic levels
- cumulative impacts of the proposed project and other potential local developments

In addition to providing a response to each comment received, DOE revised the appropriate sections to provide any requested information that was newly available or to further explore areas of potential impact. Additional technical details not available at the time of issuance of the Draft EIS enabled further revisions and additions to the Final EIS. The revisions and additions are indicated by underscored text.

1.6 Content of this Environmental Impact Statement

By addressing the following issues, this EIS provides a comprehensive assessment of reasonably foreseeable consequences from the Proposed Action:

- potential effects on the Kentucky River
- effects of air emissions from the Kentucky Pioneer IGCC Demonstration Project
- potential effects on the public and workers during normal operations
- potential effects on members of the public, including minority and low-income populations, from normal operations and reasonably foreseeable accidents
- pollution prevention, waste minimization, and energy and water use reduction technologies to minimize environmental impacts
- potential socioeconomic impacts, including potential impacts associated with the number of workers needed for operations
- potential impacts on cultural and historic resources
- compliance with applicable federal, state, and local requirements
- potential cumulative impacts of all past, present, and reasonably foreseeable future operations in the local area
- potential irreversible and irretrievable commitment of resources
- potential environmental impacts associated with constructing and operating the Kentucky Pioneer IGCC Demonstration Project

1.7 Regulatory Issues

The proposed facility would be the first commercial-scale demonstration of a co-fed BGL gasifier in the United States. The gasifier units used would also be between 40 and 50 percent larger than other existing gasifier units, allowing for greater electrical output from the facility. Because of the size and innovative nature of the technology to be demonstrated, there are two outstanding issues remaining to be resolved. They can be summarized into two main categories as follows:

- the potential of the vitrified frit to be hazardous under the *Resource Conservation and Recovery Act* (RCRA); and
- the use of water in the facility and competing demands for water

This section will detail the status of each of these issues and steps that have been taken to resolve any controversy.

1.7.1 Vitrified Frit

The vitrified frit is a glassy, silica-like matrix material produced as a byproduct of the gasification process. Because frit has not been produced by the gasification of co-fed coal and RDF as proposed by this project, no data is available to determine the potential for the frit to leach and be classified as hazardous waste, which under state law is defined at Kentucky Revised Statutes 224.01-010(31b). The state procedures for identifying hazardous waste are detailed in Title 401, Kentucky Administrative Regulations, Chapters 31 and 32. The first batch of frit would be subjected to Toxicity Characteristic Leaching Procedure testing to determine if it is a hazardous waste under RCRA and applicable Kentucky laws and regulations.

The frit from gasifiers operating on a 100 percent coal feed has consistently proven to be nonhazardous under RCRA, and the process has been shown to produce a relatively consistent frit regardless of the type of coal used in the fuel feed. KPE is proposing to sell the frit as a marketable product, but this will only be possible if the frit is deemed nonhazardous. Should the frit be determined to be hazardous under RCRA, KPE would bear all financial costs associated with handling and disposal of the material. Therefore, if the frit is found to be hazardous, it would be necessary for KPE to review the gasification process and adjust the operation in order to alter the qualities of the frit. Ultimately, if process adjustments failed to produce a nonhazardous frit, KPE could decide to use 100 percent coal feed as a means to achieve a nonhazardous frit material. Impacts associated with use of a 100 percent coal feed would be expected to be essentially the same as the impacts examined under the Proposed Action (the 50-50 co-feed), except for those impacts directly attributable to the RDF, which would be primarily impacts associated with transportation and storage activities.

1.7.2 Water Resources

The Kentucky Pioneer IGCC Demonstration Project facility would withdraw approximately 15.1 million liters per day (4.0 million gallons per day) of water from the Kentucky River. This is equivalent to 0.1 percent of the daily average flow and 4 percent of the 7-day low flow with a statistical recurrence interval of 10 years. Of this amount, 1.5 million liters per day (0.4 million gallons per day) would be returned to the Kentucky River as treated wastewater. KPE would not be required to obtain a permit for the withdrawal because they would use the existing EKPC pipeline. EKPC's existing water permit would require modification for the additional withdrawals.

The large amount of water removed and associated discharges back into the river have raised a number of concerns about competing uses of the water. The main concern is that the city of Lexington uses the Kentucky River as its source of drinking water and during low flow conditions, adequate supply of water for the city may not be available due to the withdrawals required by the plant. KPE has indicated that it would

work with the Kentucky Department of Environmental Protection, Division of Water, during low flow conditions and would cease plant operations and withdrawals from the river if required.

2. PURPOSE AND NEED FOR AGENCY ACTION

2.1 Proposed Action

The proposed federal action is for the U.S. Department of Energy (DOE) to provide, through a Cooperative Agreement with Kentucky Pioneer Energy, LLC (KPE), a subsidiary of Global Energy, Inc., approximately $60 million in cost-shared funding support for the design, construction, and operation of the proposed Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project. The total cost of the project is currently estimated to be $414 million. The IGCC is a technology that converts coal into clean gas, virtually free of sulfur and particulates, burns the gas in a combustion turbine to generate electricity, and then captures the heat to drive a steam turbine, which generates additional electricity.

The proposed project would include four coal and refuse derived fuel (RDF) gasification units and a 540 megawatt (MW) synthesis gas-fired combined cycle power plant in rural Clark County, Kentucky. KPE would use a licensed gasification technology to fuel an electric generating facility. The facility would be designed for at least 20 years of commercial operation, with KPE providing data from the proposed Clean Coal Technology (CCT) demonstration for the first year. The proposed project would be the first commercial application of a modified version of the British Gas Lurgi (BGL) gasification technology in the United States. The important modification to the BGL technology is the gasification of a blend of coal and RDF pellets.

The IGCC system that would be demonstrated in this project is suitable for repowering both existing and new power plants. The technology is expected to be adaptable to a wide variety of potential market applications because of several factors. First, pilot scale tests of the BGL gasification technology have successfully used a wide variety of coals within the United States. Also, the highly modular approach to system design makes the BGL-based IGCC competitive in a wide range of plant sizes. In addition, the high efficiency and environmental performance of the system are competitive with other fossil-fuel-fired power generation technologies.

The Kentucky Pioneer IGCC Demonstration Project facility would be designed for at least 20 years of commercial operation. The first year of facility operation would demonstrate the co-fed BGL gasification technologies. Construction of the entire facility would require approximately 30 months.

As originally proposed, the project included a high temperature molten carbonate fuel cell. However, in July 2002, DOE decided to move the fuel cell demonstration portion of the Kentucky Pioneer IGCC Demonstration Project to Global Energy's Wabash River IGCC plant near West Terre Haute, Indiana. By utilizing an already existing commercial IGCC plant with experienced operating personnel, this re-siting would advance the projected fuel cell demonstration schedule by more than 1 year, thereby providing potential for the technology to enter the market at an earlier date. The fuel cell component accounts for approximately $16 million of the overall Kentucky Pioneer IGCC Demonstration Project cost and will decrease DOE's cost-share allocation for the project by that amount. Accordingly, the fuel cell is no longer considered as part of the Proposed Action and subsequent discussion and analysis related to the fuel cell has been moved in this Final EIS.

2.2 Purpose and Need for Agency Action

The goal of the CCT Program, as established by Congress, is to make available to the United States energy marketplace advanced and environmentally responsive technologies that will help alleviate pollution problems from coal utilization. Solutions to a number of key energy issues are directly dependent upon the degree to which coal can be considered as an available energy option. These issues include: (1) long-range requirements for increased power demand; (2) need for energy security; and (3) increased competitiveness in the international marketplace.

The proposed Kentucky Pioneer IGCC Demonstration Project was selected as one of the candidate projects that would best further the objectives identified in the CCT Program. The purpose of this proposed project is to demonstrate and assess the reliability, and maintainability of a utility-scale IGCC system using high-sulfur bituminous coal and an RDF blend in an oxygen-blown, fixed-bed, slagging gasifier. The proposed project was also selected to demonstrate the combined removal of sulfur dioxide, nitrogen oxides, and particulate matter using BGL gasification technology. The project would be the first demonstration of the coal and RDF pellet co-feed gasification technology; and the total facility output would also be between 40 and 50 percent larger than other facilities utilizing BGL technology. As with other clean coal projects, an overall objective is to achieve emission levels lower than the limits established by the *Clean Air Act* while producing power more efficiently and at a lower cost than conventional coal utilization technologies. The co-feed aspect of the project would potentially demonstrate a means to extend the life of the Nation's coal reserves.

The proposed project could meet DOE's objective to generate technical, environmental, and financial data from the design, construction, and operation of the facilities at a scale large enough to allow the power industry to assess the potential of co-fed BGL gasification technologies for commercial application. This data could demonstrate that IGCC power plants, based on this technology, could be built cost effectively, with thermal efficiencies that would significantly reduce electric power costs over more conventional technologies.

KPE is proposing to construct the Kentucky Pioneer IGCC Demonstration Project at East Kentucky Power Cooperative's (EKPC) existing J.K. Smith Site due to existing and projected electrical loads on the EKPC system. Electrical load forecasts outlined in EKPC's *1998 Power Requirements Study* indicates that the total energy requirements for EKPC's system are expected to increase by 3.0 percent per year through 2017. Net winter peak demand is expected to increase by over 1,600 MW or 3.3 percent per year and net summer peak demand is projected to increase by approximately 1,250 MW or 3.0 percent per year. Peak is projected to increase from 2,031 MW in 1998 to 2,394 MW in 2003 and 3,478 MW in 2015. Based on this load growth, EKPC will need additional power supply resources of 625 MW in 2003. The Kentucky Pioneer IGCC Demonstration Project is being recommended by KPE to satisfy the majority of the projected electrical load growth on EKPC's existing system while demonstrating a CCT. This environmental impact statement will help DOE decide whether or not to provide $60 million in cost-shared funding for the Kentucky Pioneer IGCC Demonstration Project.

The need for greater electrical generation in the region is demonstrated by EKPC's plans to construct four new combustion turbine (CT) electric generating units (addressed in Section 5.14, Cumulative Impacts) to provide peaking service alongside their three existing peaker CTs at the J.K. Smith Site. The construction of the 540 MW power plant will help to assuage the need for electricity in the region. The intent of the proposed project is to demonstrate a more environmentally-friendly method of electric generation and help to reduce the impacts associated with conventional generation technologies.

If enough data is generated, the proposed Kentucky Pioneer IGCC Demonstration Project could advance DOE's objective of demonstrating technical, economical, and environmental viability of commercial scale operation of coal-based power generation technologies with a module that could be replicated for use by utilities and other industries in the near future. This project represents an integration of the latest developing gasification and power generation technologies to provide industry and electric utilities with a major source of clean, dependable, and economical electricity.

The commercialization of environmentally progressive technologies using coal, which is a relatively inexpensive fuel source, is important to the electric utility industry as it endeavors to balance environmental costs and benefits of generating electricity. The proposed Kentucky Pioneer IGCC Demonstration Project could make a significant contribution to the new technologies available to electric-generating utilities, independent power producers, and co-generators in their efforts to produce power economically from abundantly available coal in an environmentally acceptable way.

3. KENTUCKY PIONEER IGCC DEMONSTRATION PROJECT DESCRIPTION AND ALTERNATIVES

3.1 Kentucky Pioneer IGCC Demonstration Project Facility

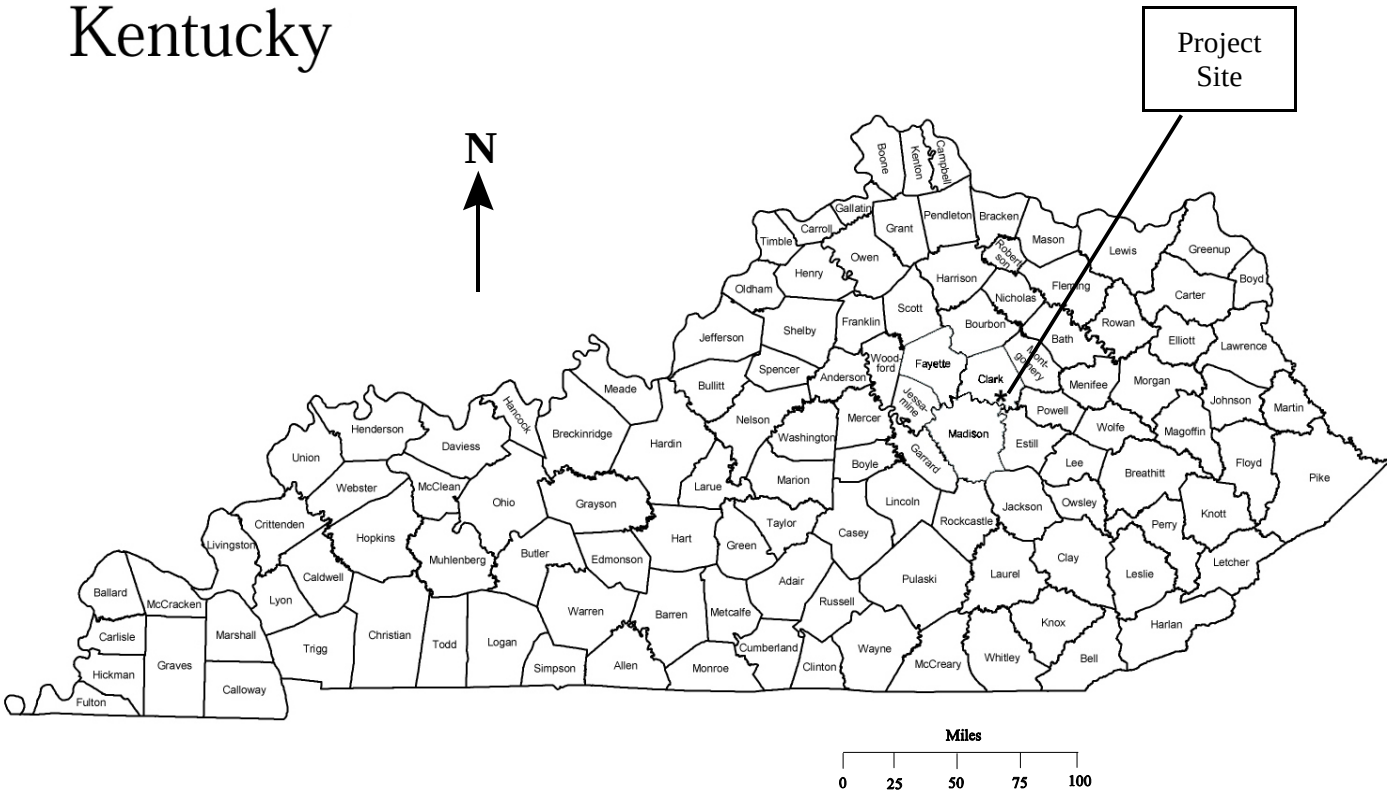
The Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project facility would be located in Clark County, Kentucky (Figure 3.1-1) on a 121-hectare (300-acre) site within the 1,263-hectare (3,120-acre) J.K. Smith Site, owned by East Kentucky Power Cooperative (EKPC) (Figure 3.1-2). The project site is 34 kilometers (21 miles) southeast of the city of Lexington, 13 kilometers (8 miles) southeast of the city of Winchester, and 1.6 kilometers (1 mile) west of the community of Trapp, Kentucky.

The 121-hectare (300-acre) project site was previously disturbed by preliminary construction activities in the mid-1980s when EKPC began construction of the J.K. Smith coal-fired power station. EKPC had completed preliminary grading, primary foundations, fire protection piping, and rail spur access infrastructure installation before the project was canceled in the early 1990s when the projected demand for electricity in the area failed to materialize. The Kentucky Pioneer IGCC Demonstration Project would be built on the portion of the site that was previously cleared and graded. Figures 3.1-3 to 3.1-6 illustrate the current site conditions.

The site is reached by Kentucky Highway 89 and accessed through a gated perimeter fence and access road. The access road is approximately 1.6 kilometers (1 mile) long from Kentucky Highway 89 to the project site. Plant access by rail, which crosses the eastern side of the station, would be from a freight rail line owned by CSX Transportation, Inc. (Figure 3.1-7). An existing railroad loop about 5 kilometers (3.1 miles) long will be utilized for raw material delivery and product transportation around the 121-hectare (300-acre) project site (Figure 3.1-8).

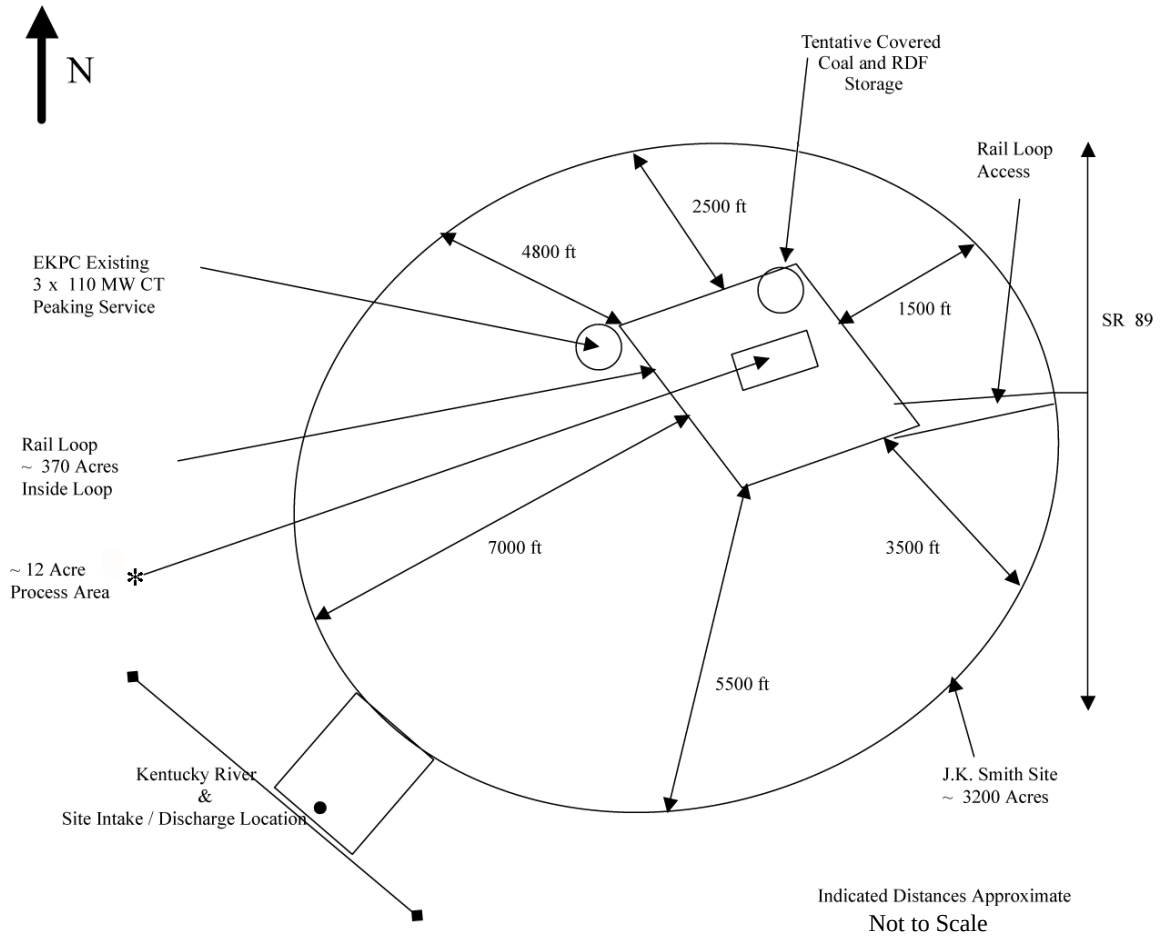
To support the project, EKPC would construct a new 138-kilovolt (kV) electric transmission line. The proposed route for the line would extend northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky, where it will interconnect with the existing local power grid. Figure 3.1-9 shows the location of the Spencer Road Terminal with respect to the proposed project site. This transmission line would provide additional capacity adequate to accommodate the addition of the Kentucky Pioneer IGCC Demonstration Project and is consistent with the master plan for transmission outlets required for existing and future generation at EKPC's J.K. Smith Site. However, the resulting margin of transmission capacity of the Kentucky Pioneer IGCC Demonstration Project plus the existing and planned EKPC combustion turbines (CTs) is small, thus triggering the need for future expansion of the local power grid. The impacts of potential future expansion of the grid are addressed in Section 5.14, Cumulative Impacts.

The proposed new transmission line would be approximately 27 kilometers (17 miles) in length; however, the exact route for the line has yet to be determined. For this environmental impact statement (EIS), it is assumed the transmission line would be constructed in a similar fashion as other 138-kV electric transmission lines built by EKPC in the project area. The line would require a 30 to 45 meter (100 to 150 foot) wide right-of-way. The electrical conductors would be supported by double wood and/or steel, single and/or double pole structures. The average height of the support structures would be approximately 24 meters (80 feet) aboveground and the average span between structures would be 122 to 305 meters (400 to 1,000 feet), depending upon the terrain (Figure 3.1-10).



Source: KY 2001.

Figure 3.1-1. Project Site Location within Kentucky



Source: KPE 2001.

* See Figure 3.1.1-2 for Conceptual Facility Layout located in the Process Area

Figure 3.1-2. Kentucky Pioneer IGCC Demonstration Project Facility Location at J.K. Smith Site

Source: EKPC 2000b.

Figure 3.1-3. Current Site Conditions at the Kentucky Pioneer IGCC Demonstration Project Site, Looking South on Existing Water Tank

Source: EKPC 2000b.

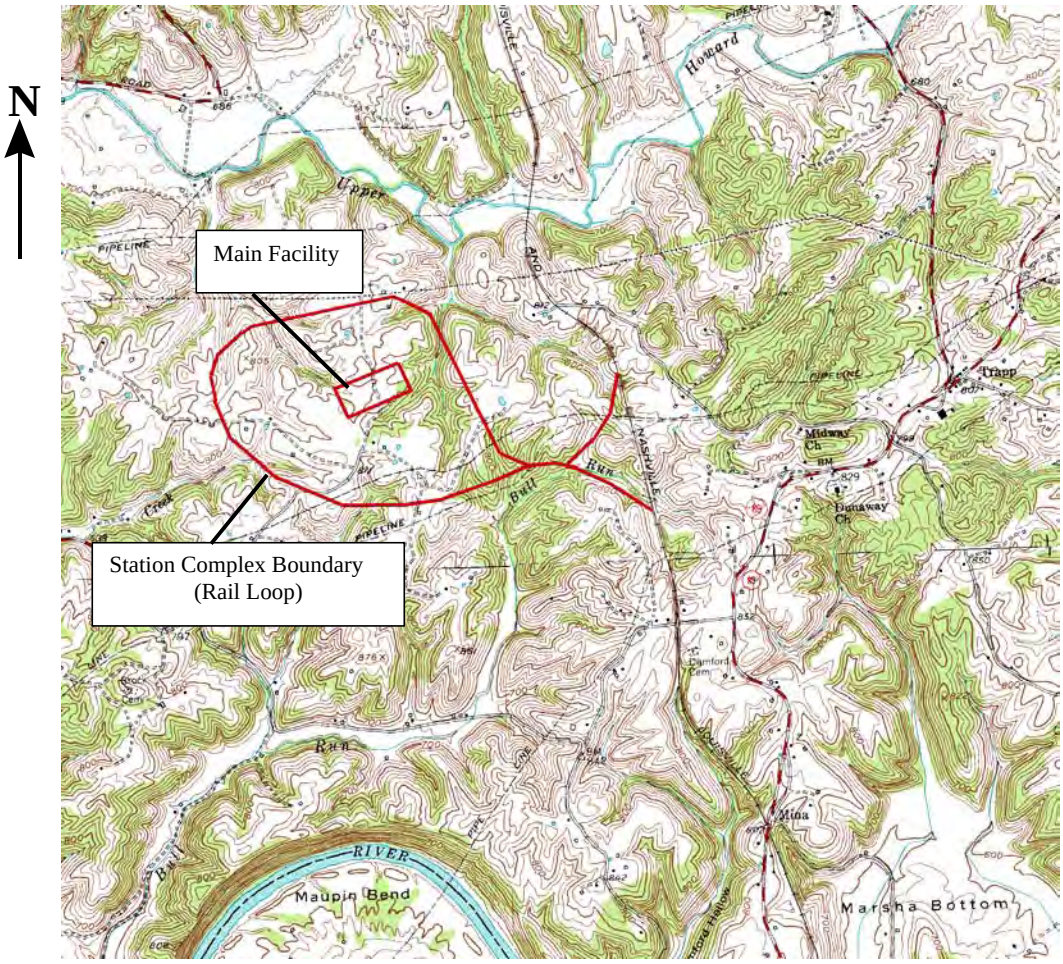
Figure 3.1-4. Current Site Conditions at the Kentucky Pioneer IGCC Demonstration Project Site, from Existing Water Tank Looking North to the Rail Spur

Source: EKPC 2000b.

Figure 3.1-5. Current Site Conditions at the Kentucky Pioneer IGCC Demonstration Project Site, from Existing Water Tank Looking East/Southeast

Source: EKPC 2000b.

Figure 3.1-6. Current Site Conditions at the Kentucky Pioneer IGCC Demonstration Project Site, from Existing Water Tank Looking South/Southwest with Administrative Buildings in the Background



Source: EIV 2000.

Figure 3.1-7. Topographic Map of the Project Site

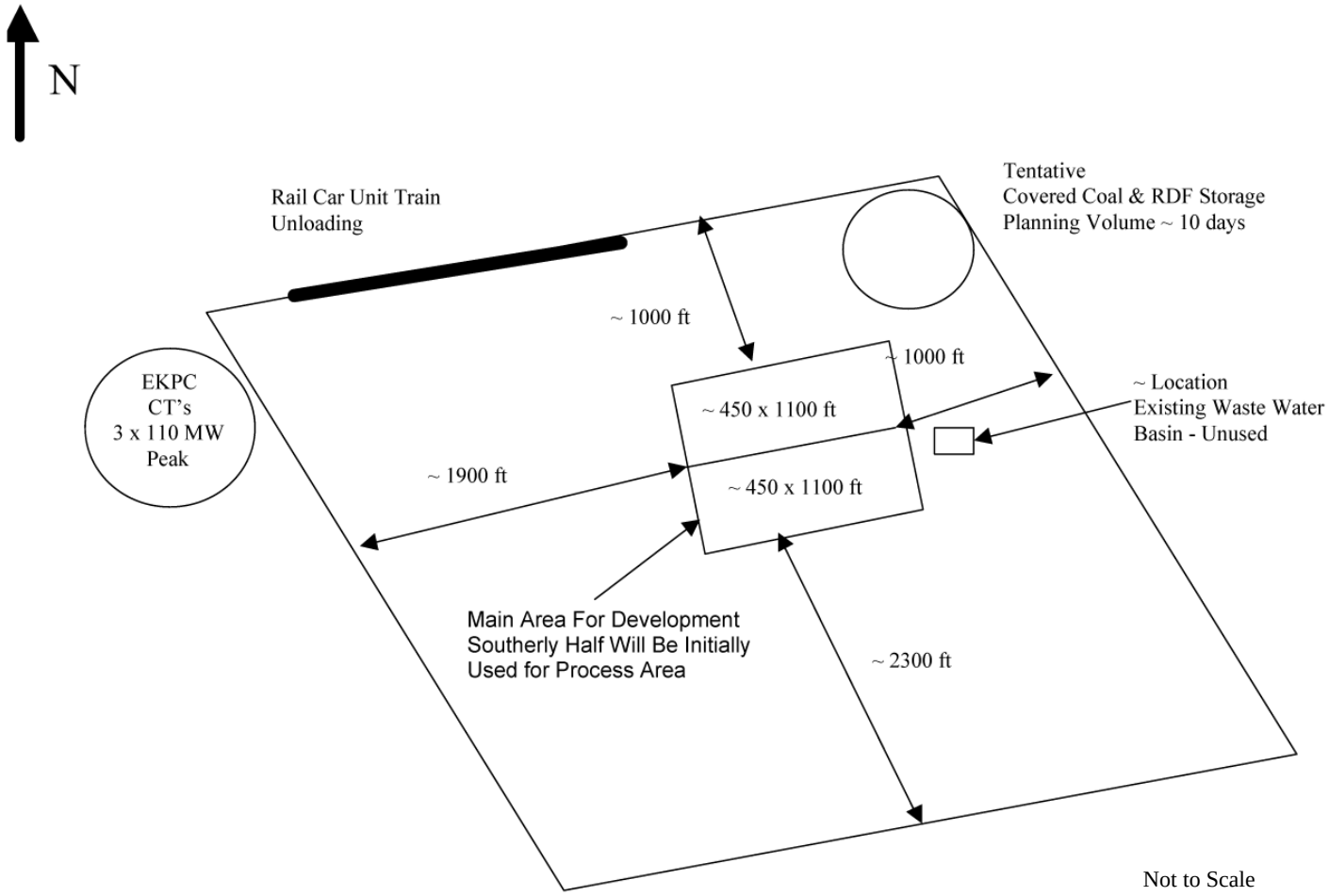


Figure 3.1-8. Generalized Rail Loop Layout for Kentucky Pioneer IGCC Demonstration Project Facility

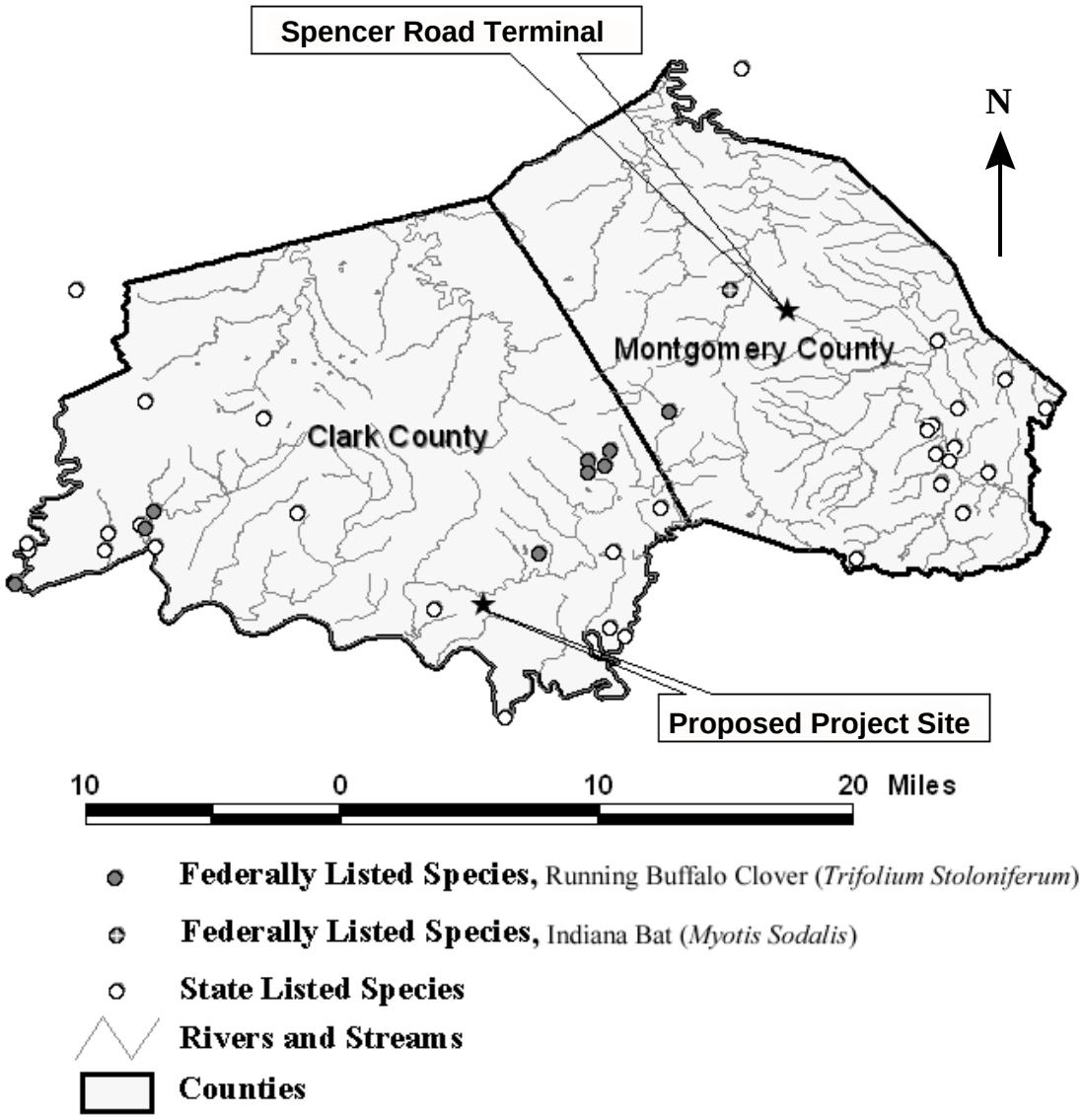
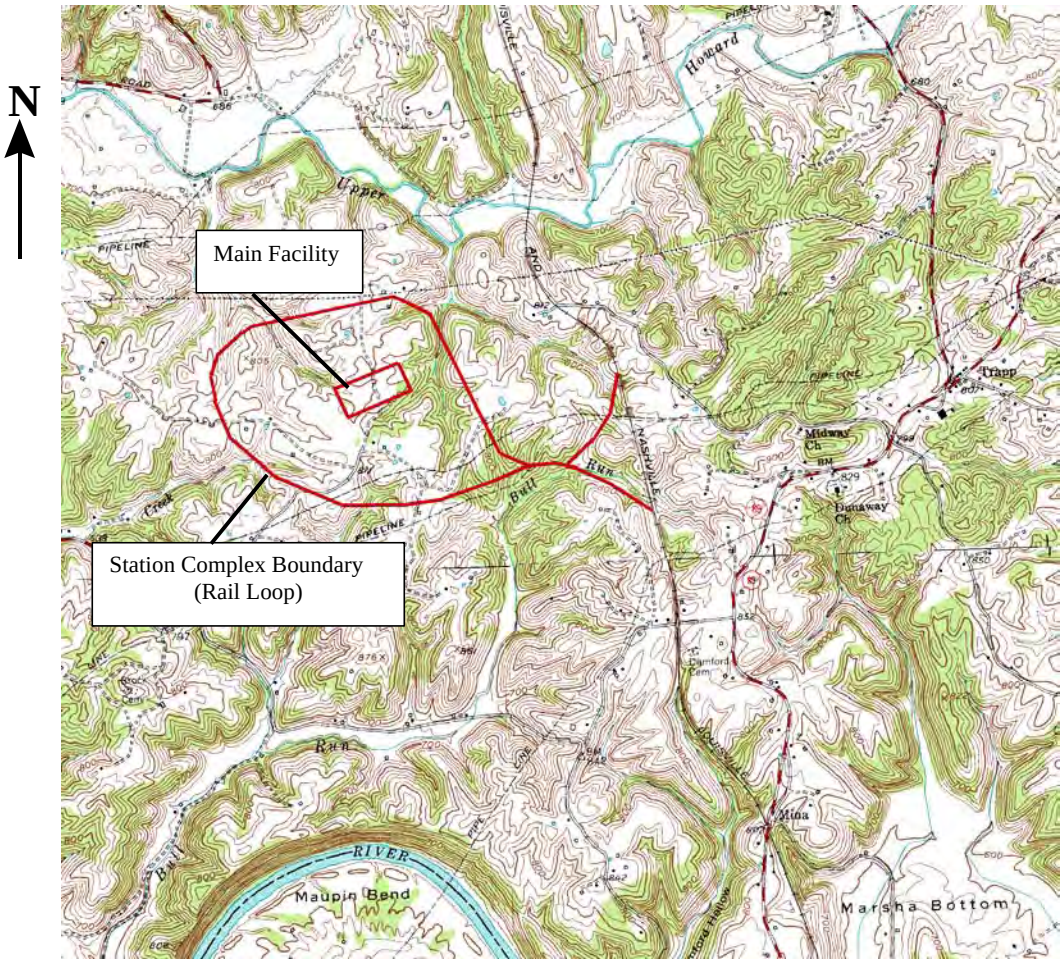


Figure 3.1-9. Spencer Road Terminal and Sensitive Areas in Clark and Montgomery Counties



Source: EIV 2000.

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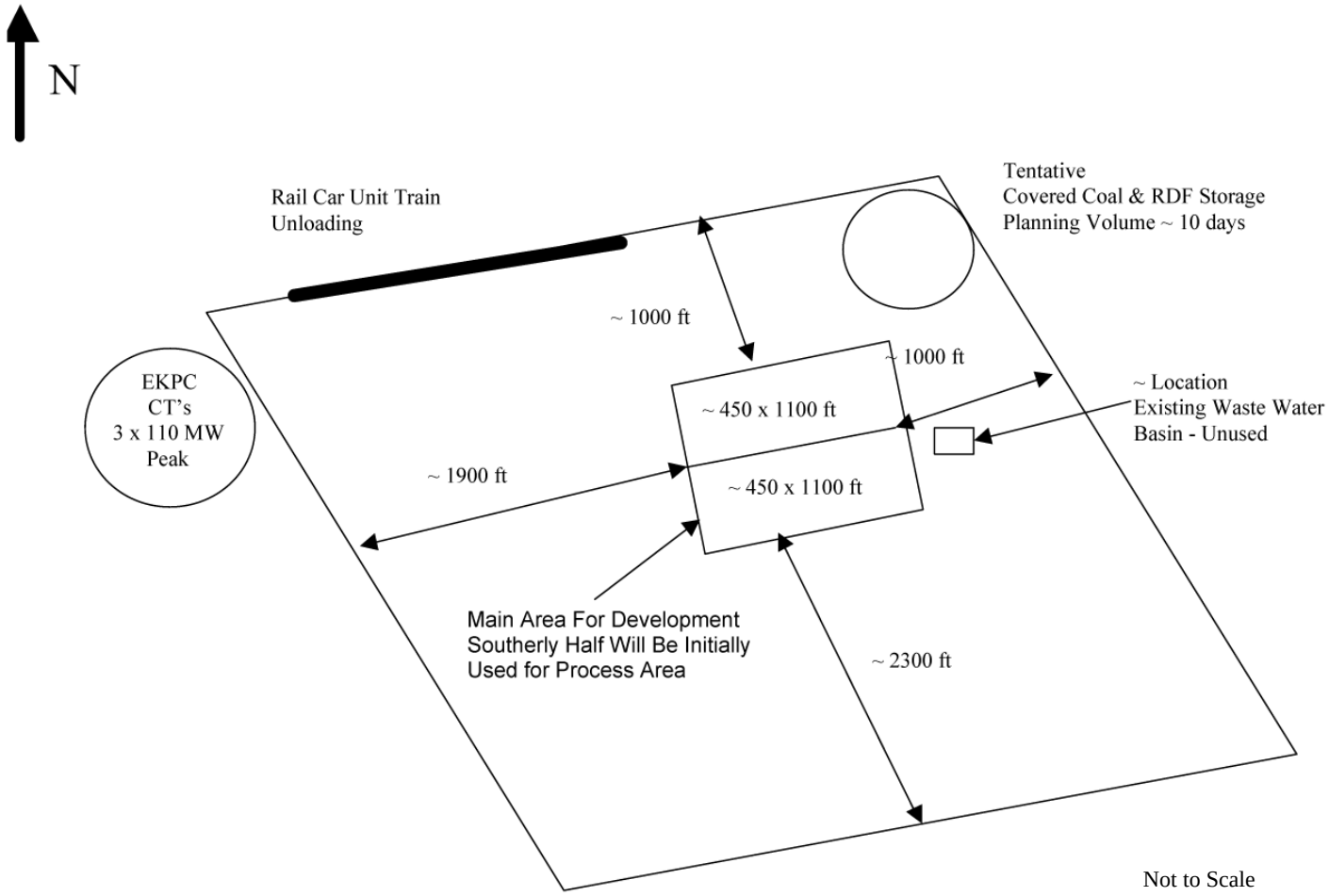

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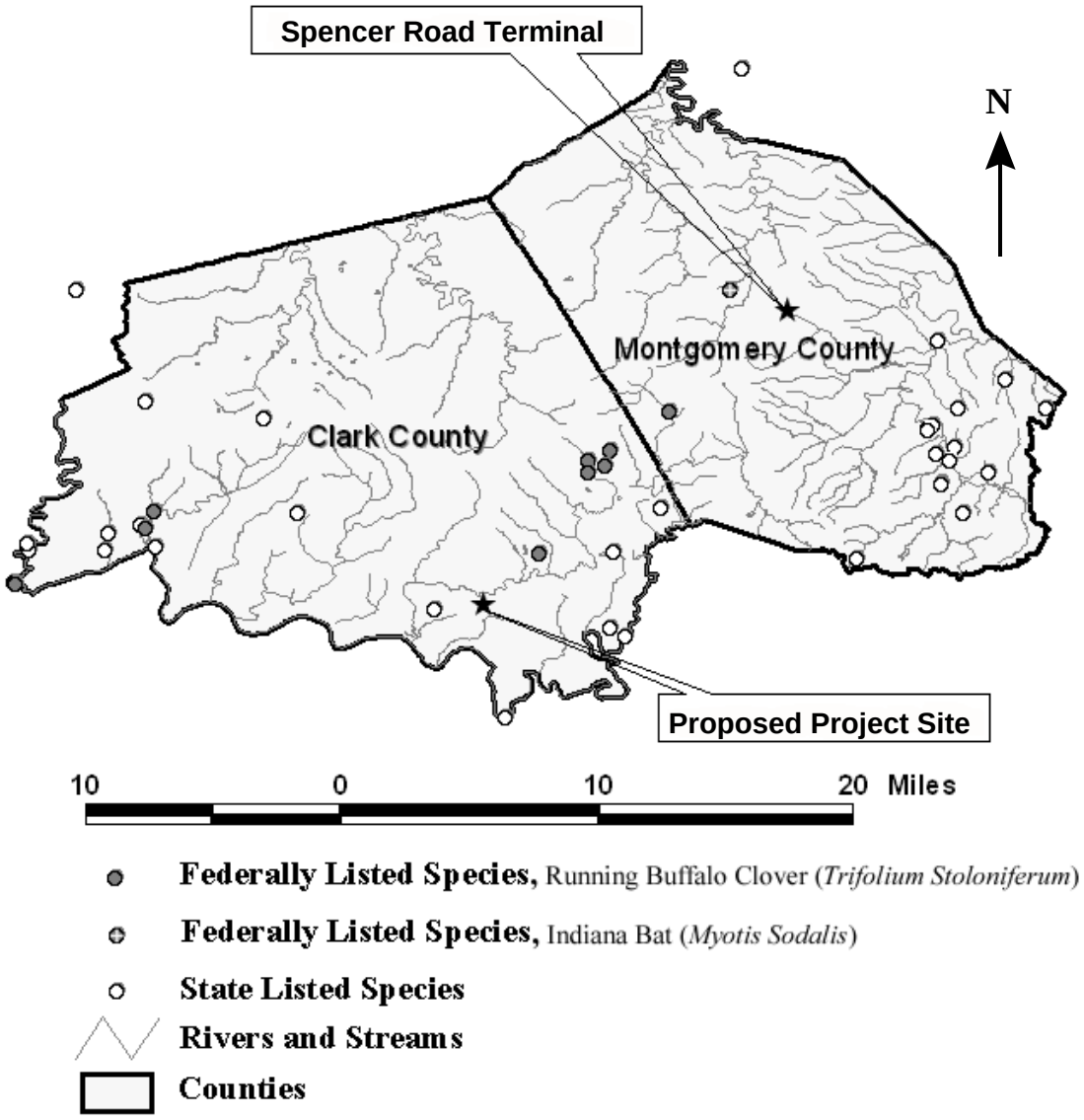
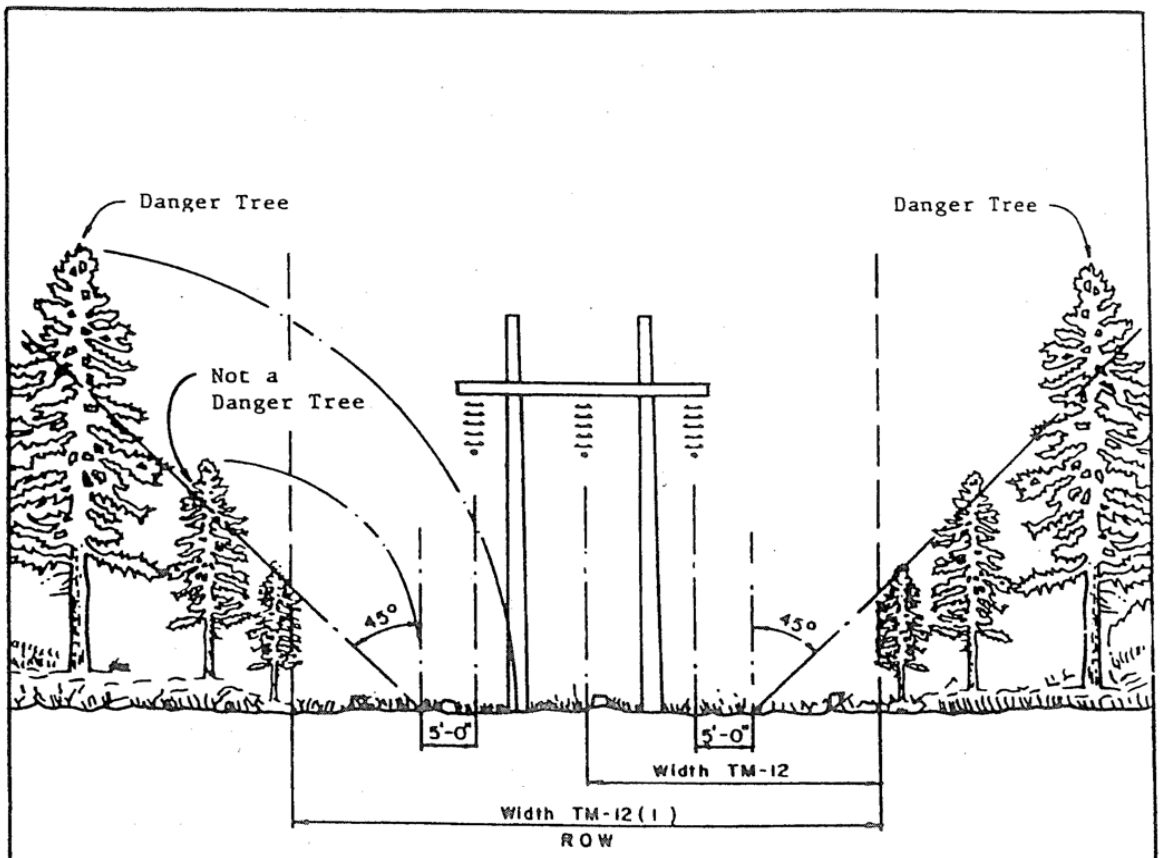


Figure 3.1-9. Spencer Road Terminal and Sensitive Areas in Clark and Montgomery Counties



NOTES:

1. Engineer will designate all danger trees which shall be removed or topped at option of contractor. In approximately level terrain, trees which would reach within 5 feet of a point underneath the outside conductor in falling are examples of danger trees.

2. As directed by the engineer, portions of the right-of-way (ROW) must be cut so that stumps will not prevent the passage of tractor and trucks along the ROW.

3. The unit for clearing one-half of the ROW is "WIDTH TM-12."

4. The unit for clearing the full ROW is "WIDTH TM-12(1)."

5. The unit for clearing danger trees is "TM-13."

Figure 3.1-10. Typical East Kentucky Power Cooperative 138-kV Transmission Line

As stated previously, the exact route of the transmission line is yet to be determined. The U.S. Department of Agriculture's Rural Utility Service (RUS) has approval authority for this capacity upgrade (Global Energy 2000b). Under RUS *National Environmental Policy Act* (NEPA) policies and procedures, transmission lines of less than 230 kV and less than 40.2 kilometers (25 miles) may be categorically excluded from the requirement to prepare an EIS under NEPA. Transmission lines in this category normally require an Environmental Report (ER) for the application to be approved (7 CFR 1794.22).

The direct-line distance between the proposed station location and the Spencer Road Terminal is 24 kilometers (14.9 miles). The proposed 138-kV transmission line is 27 kilometers (17 miles) in length, therefore the proposed route would only deviate to either side of the direct line between the two locations by a maximum of 1.6 kilometers (1 mile). This establishes a 3.2-kilometer-wide (2-mile-wide) corridor between the proposed site location and the Spencer Road Terminal into which the route must fit. The transmission line should follow existing routes to the greatest extent practicable. The terrain in this corridor is typified by gently rolling hills and land use is predominantly agricultural, with a few small areas of mixed woodland and agricultural land. There are very few residences along the proposed route as it runs through areas classified as rural. The geology in this area is similar to that found at the project location, as described in Section 4.6, Geology.

The proposed route may cross between approximately five and ten creeks and streams, as shown in Figure 3.1-9. Many of these streams are intermittent and ephemeral and would not be directly affected by construction of the transmission line. Cultural resources, such as historic sites and structures, may also be encountered along the route. The typical construction procedures that would be implemented would minimize impacts to these resources by avoiding the locations during route planning. Intermittent and ephemeral streams are typically crossed during periods of no recorded flow. Impacts to streams would most likely be minor should a flow be present during construction, since the line would pass over the creek or stream.

As Figure 3.1-9 shows, there are seven locations along or near the area which would contain the transmission line route where federally-listed endangered species have been shown to occur. Six of these seven locations represent the presence of the endangered plant, running buffalo clover (*Trifolium stoloniferum*), with the seventh, located to the northeast of the Spencer Road Terminal, representing the presence of the endangered mammal, the Indiana bat (*Myotis sodalis*). To prevent any impacts to these endangered species and their habitat, the route would be established to avoid these locations and could be constructed underground, if necessary. If construction were required near the location of the Indiana bat habitat, special procedures would be required. Any required tree removal could only occur during the bat's hibernation period, which occurs between November 15th and March 31st.

The transmission line would be constructed to support the power island combined cycle units regardless of approval of the Proposed Action. Therefore, it is considered a related action for both No Action Alternative 2 and the Proposed Action.

3.1.1 Kentucky Pioneer IGCC Demonstration Project Facility Description

The Kentucky Pioneer IGCC Demonstration Project facility would be located on a 121-hectare (300-acre) tract within the 1,263-hectare (3,120-acre) J.K. Smith Site. The facility would demonstrate the following innovative technologies: (1) gasification of a blend of coal and refuse derived fuel (RDF) pellets; and (2) the utilization of a synthesis gas (syngas) product as a clean fuel in combined cycle turbine generator sets. The project would be a commercial operation, and is expected to be active for at least 20 years.

The total cost of the Kentucky Pioneer IGCC Demonstration Project is currently estimated to be $414 million. Kentucky Pioneer Energy, LLC (KPE), has indicated that approximately 80 percent ($331.2 million) of the project cost is allocated for the construction and operation of the British Gas Lurgi (BGL) Process facility demonstration portions of the project. The proposed federal action is for DOE to provide, through

a Cooperative Agreement with KPE, a subsidiary of Global Energy, Inc., approximately $60 million (approximately 15 percent of overall $414 million project cost) in cost-shared funding support for the design, construction, and operation of the proposed demonstration facilities.

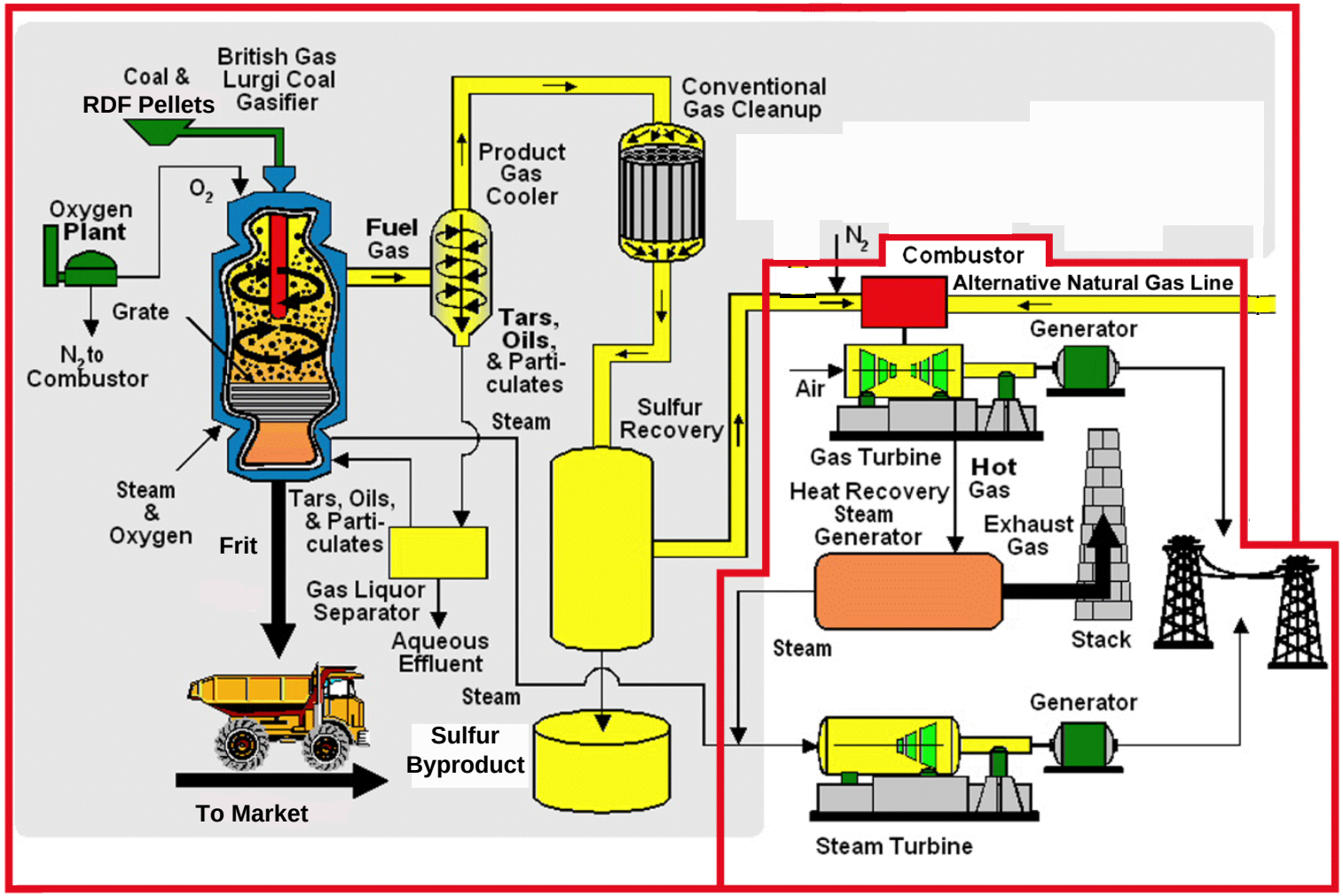
Figure 3.1.1-1 presents a conceptualized layout and process flow of the complete Kentucky Pioneer IGCC Demonstration Project facility. To facilitate discussion of the project, the layout has been divided into the following two parts: (1) the combined cycle units, or power island; and (2) the BGL process demonstration, or gasification island.

The estimated project cost of the power island would be $86.4 million. The primary power production area would consist of two General Electric (GE) 7FA CTs coupled to a Heat Recovery Steam Generator. The GE 7FA CT is a heavy duty, industrial type machine with high efficiency and low nitrogen oxide (NO_x) and carbon monoxide (CO) emissions. F-Frame turbines are single-casing, single-shaft machines with a common rotor. The turbine sits on a horizontal axis with the cold end (compressor end) attached to the generator. The turbines have axial exhaust for improved efficiency. The F-Frame combustion turbine can attain 100 percent power load within 30 minutes and generate about 197 megawatts (MW). The Heat Recovery Steam Generator is coupled to the GE 7FA turbine and utilizes the hot exhaust to create steam. This steam then drives another turbine to create an additional 93 MW of electricity, thus improving the efficiency of the fuel source over conventional turbine generation methods. The two-unit facility is designed to generate 580 MW of gross electricity, of which approximately 40 MW would be used to operate the facility. Thus, it would produce a net power output of 540 MW. The turbines would be fired with natural gas under No Action Alternative 2 and with syngas fuel should the Proposed Action proceed. Under the Proposed Action, the turbines would operate on natural gas only if the gasifiers would be taken off line for maintenance. Natural gas is available as a fuel supply from an existing EKPC supply line and can alternatively be supplied, if necessary, from several nearby transmission pipelines (EIV 2000).

The Proposed Action is to provide cost-shared funding for the construction and operation of the power and gasification islands. The proposed project would consist of the following major facility components: (1) RDF pellet and coal receipt and storage sheds; (2) gasification plant; (3) sulfur removal and recovery facility; (4) air separation plant; and (5) two combined cycle power units. The production of syngas in the BGL process occurs in the gasification plant and utilizes the sulfur removal and recovery facility and air separation plant.

Under the Proposed Action, the combined cycle turbines would be fired with syngas. The syngas firing process consists of the following four steps: (1) generation of syngas from RDF pellets and coal reacting with steam and oxygen in a high temperature reducing atmosphere; (2) removal of contaminants, including particulates and sulfur in the sulfur removal and recovery facility; (3) clean syngas combustion in a gas turbine generator to produce electricity; and (4) recovery of residual heat in the hot exhaust gas produced by the gas turbine. The residual heat is used to generate steam in a heat recovery steam generator that produces additional electricity in a steam turbine, which is the combined cycle aspect of the plant.

KPE will not begin detailed design of the proposed project, including layout and flowsheet information, until the project financing is finalized. However, KPE has provided rough general estimates of quantities of materials required for the construction of the gasification island facilities. The estimates are as follows: steel - 160,000 tons; concrete - 145,000 tons; pipe - 140,000 tons; and wire - 100,000 tons. Figure 3.1.1-2 identifies a conceptual facility layout depicting the major process elements of the project.



Source: NETL 2001.

Figure 3.1.1-1. Concept Layout and Process Flow of the Kentucky Pioneer IGCC Demonstration Project Facility

3.1.2 Kentucky Pioneer IGCC Demonstration Project Process Description

The following subsections describe the facility and project processes. Figure 3.1.1-1 provides a process flow diagram for the Kentucky Pioneer IGCC Demonstration Project.

3.1.2.1 Raw Material Receipt, Storage, and Preparation

The primary raw materials used in the BGL gasification process would be high-sulfur coal, RDF pellets manufactured from municipal solid waste (MSW), limestone, and petroleum coke. The RDF pellets and high-sulfur coal would be received at the project facility by railcar from offsite. RDF pellets would be shipped in covered cars or closed containers. They would be unloaded in an enclosed concrete-floored environment containing electric feed conveying equipment in accordance with the Final PSD/Title V Air Permit obtained by KPE on June 7, 2001. This equipment would move the material into the covered storage area, which would be enclosed and concrete contained. A single building or enclosure is envisioned for storage of both RDF pellets and coal. Dust control would be integral to the enclosed unloading and handling system and conform to air permit emission limits in the Final PSD/TitleV Air Permit. Receiving, storage, and handling systems would be covered and weather protected to avoid precipitation and runoff management concerns.

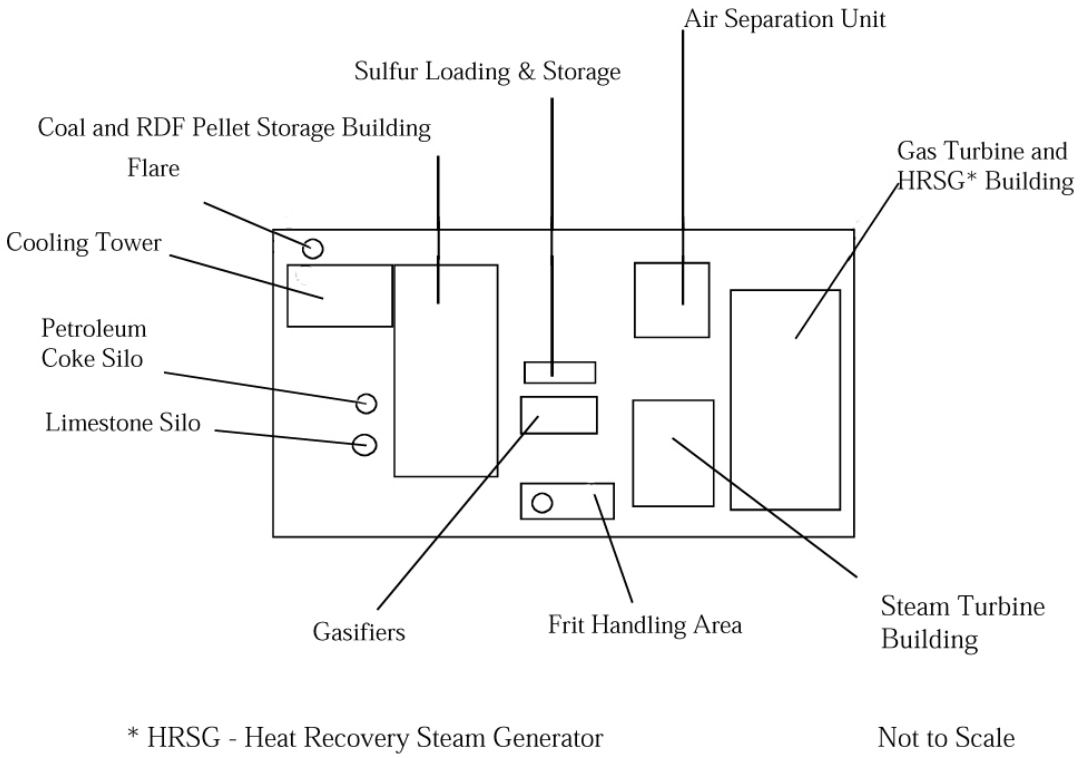
The storage building would be sized to house approximately a 10-day supply of coal and RDF pellets (Global Energy 2000b). The building would be located within the 121-hectare (300-acre) project site. Limestone would also be received by railcar and stored in silos onsite. Each of the silos would have a storage capacity of 272 metric tons (300 tons). RDF pellets, coal, and limestone would be transported from the single building and silos to the gasifier by covered conveyers to ensure a high level of control of particulate emissions. During the demonstration period, the facility would use a co-feed of RDF pellets and high-sulfur coal at a 1:1 ratio. To operate the facility, approximately 745,022 metric tons per year (821,250 tons per year) each of RDF pellets and coal would be required (EIV 2000).

3.1.2.2 Continuous Gasification Process

This section describes the three stages comprising the continuous gasification process. The air seperation process, BGL gasification, and sulfur removal and recovery would all occur concurrently during the gasification process; however, each stage occurs in a separate facility. This section describes each stage and facility separately to develop an understanding of the process and is not intended for use as a chronological sequence description of the gasification process.

Air Separation Process

The purpose of the air separation plant is to extract oxygen (O_2) and N_2 from the atmosphere for use in the gasification process. An on-site air separation unit would supply approximately 1,814.4 metric tons (2,000 tons) per day (TPD) of O_2 to the gasifiers. The air separation unit will also supply N_2 for the dilution of fuel gas before it is used in the gas turbines. The air separation unit uses electricity generated by the facility to satisfy its energy needs and has no direct emissions. The air separation plant would use either cryogenic or pressure swing processes to purify air from the atmosphere through a series of separation steps.



Source: EIV 2000.

Figure 3.1.1-2. Kentucky Pioneer IGCC Demonstration Project Facility Conceptual Layout

BGL Gasification

The gasification process occurs in four BGL gasifiers which are fixed-bed, oxygen-blown slagging gasifiers that operate at a pressure of approximately 350 to 450 pounds per square inch-gauge and have a temperature range of as high as 1,982 degrees Celsius (°C) (3,600 degrees Fahrenheit [°F]) in the lower section of the reactor to approximately 482°C (900°F) in the upper section of the reactor. A syngas is produced from the high temperature and low oxygen environment in the reactor which causes the decomposition of the feed into its basic elements. The BGL gasification process is a pressurized, closed process that has no emissions or stack. However, in case of a malfunction, the gasifiers would be routed to an emergency flare. Petroleum coke would be used for the cold startups of the gasifiers. Approximately 54 metric tons (60 tons) of petroleum coke would be required for each of the four BGL gasifier units. KPE has indicated that once initial start-up fills are complete, further quantities of petroleum coke would be put into the storage facility for future use, when necessary. Limestone is a required component of the gasification process, comprising of approximately 2 to 3 percent of overall material feed. At the fuel feed rates proposed, approximately 127 metric tons (140 tons) of limestone would be required per day of operation.

Gasification is a process for converting materials, or, for the purposes of the Kentucky Pioneer IGCC Demonstration Project, the high-sulfur coal and RDF pellet co-feed, into syngas fuel. The composition of syngas is 55 percent carbon monoxide (CO), 30 percent hydrogen (H_2), 10 percent carbon dioxide (CO_2), and 5 percent methane and ethane. Sulfur-cleaning processes discussed in the following section reduce the sulfur component of the syngas to a maximum of 40 parts per million of hydrogen sulfide (H_2S). The process is different from incineration, which completely oxidizes carbon bearing materials to CO_2, does not allow for the recycling of materials within the system, and has low energy or heat recovery options.

Each pressurized reaction vessel, or BGL gasifier, is a long vertical tube filled with a bed of high carbon content feed material, in this case coal and RDF pellets, that is converted to syngas by the reactions occuring within the vessel. The bed of coal and RDF pellets is consumed and converted to syngas primarily at the lower level of the gasifier. The carbon content feed material is fed into the vessel through a series of feed lock hoppers, lock valves, and level gauges located near the top of the gasifier. The individual pieces of coal and RDF descend down the vertical tube in a continual stream, ultimately reaching the bottom of the gasifier, where they are consumed. Though individual pieces of coal and RDF constantly descend during gasifier operation, the column of materials is kept at a fixed height due to the system design of the feed. The constant height of the column is why each unit is called a “fixed bed” slagging gasifier.

The gasifier itself is water jacketed and lined internally with a high-temperature refractory brick. This allows for substantial thermal insulation within the unit and minimizes heat loss through the walls of the unit. This results in maximizing the thermal efficiency of the gasification process in that approximately 92 percent of the calorific, or heat, value of the coal and RDF pellets is converted to calorific value of the syngas.

At the bottom of each gasifier unit, the inner diameter narrows to form the taphole for removal of molten vitreous frit material. This narrowing of the inner diameter is sufficient to support the column of descending feed material. At the bottom of the unit, just above the narrowing of the taphole, are injection ports, also called tuyeres, for the introduction of high purity O_2, high pressure steam, and the reinjection feed for particulates, tars, oils, and other hydrocarbons removed from the raw syngas later in the process. As previously stated, the gasifier is operated at a pressure of approximately 350 to 450 pounds per square inch-gauge, though higher pressures and correspondingly higher throughput rates are possible.

Slagging fixed-bed gasification, used in the BGL process, is a thermodynamically driven chemical conversion process occurring in a stoichiometrically, or carefully, controlled environment that converts a carbon content feed material to syngas. The chemical reactions take place at high temperatures, ranging from 1,538 to 1,982°C (2,800 to 3,600°F), in the presence of steam, and in a low-O_2, chemically reducing atmosphere within the gasifier. Incineration and combustion typically occur in O_2-rich, chemically oxidizing, and non-stoichiometrically controlled environments.

Gasification involves a complex set of reactions and equilibria established within the BGL gasifier. Some of the simplified reactions that take place within the gasifier are as follows:

- $C + O_2 \div CO_2$ (exothermic)
- $2\,C + O_2 \div 2\,CO$ (exothermic)
- $C + H_2O \div CO + H_2$ (endothermic)
- $C + CO_2 \div 2\,CO$ (endothermic)
- $C + 2\,H_2 \div CH_4$ (exothermic)
- $CO + H_2O \div CO_2 + H_2$ (exothermic)
- $CO + 3\,H_2 \div CH_4 + H_2O$ (exothermic)

The exothermic reactions, as written, generate heat, while the endothermic reactions require heat input to occur as written. The stoichiometric balance of these reactions within the gasifier results in the formation of syngas that retains a substantial portion of the calorific value of the coal and RDF pellet inputs.

These reactions occur very rapidly, particularly at the temperatures established in the gasifier; however, the rates of reaction do vary. The first two reactions listed, the conversion of carbon and oxygen gas into CO_2 and CO, are the fastest to occur and take place almost instantaneously at the point of introduction of the O_2 and steam at the tuyeres. This localized area within the gasifier is referred to as the partial oxidation zone and is the area where traditional oxidation takes place. The coal and RDF are converted to CO, CO_2, and water via oxidation. A significantly higher temperature is generated in the gasifier than is possible in a conventional air-blown incinerator due to the use of pure O_2 . The minimum temperature in this zone is expected to be over 1,538°C (2,800°F), with actual temperatures ranging from 1,650 to 1,982°C (3,000 to 3,600°F). Conventional incinerators operate at a maximum temperature below 1,427°C (2,600°F) and normal operating temperatures typically range from 1,150 to 1,316°C (2,100 to 2,400°F). This significant difference in temperatures allows for increased destruction efficiency of complicated organic materials. The use of O_2 rather than air results in a major volume reduction for the raw syngas as compared to the stack emissions of a traditional incinerator, which also reduced the costs of downstream gas purification for the raw syngas.

The O_2 is almost instantaneously consumed in the partial oxidation zone, down to part per million levels, and as a result, the atmosphere within the BGL gasifier is converted to a high-temperature reducing environment, called the reducing zone. The heat released from the first two reactions then becomes sufficient to provide the necessary energy for the remaining five reactions, which are the primary gasification reactions, to proceed rapidly and generate the syngas. The reducing zone begins immediately above the limited oxidation zone and the point of introduction for the O_2. In the reducing zone, the O_2 has been completely consumed. The injected steam and the water vapor produced from the above reactions comes in contact with the incandescent carbon bed, forming H_2, CO, and some methane (CH_4) and CO_2, and acts as a powerful reducing medium. The temperature of this zone varies from the hearth temperature of 1,982°C (3,600°F) to greater than 1,316°C (2,400°F) approximately 1.2 meters (4.0 feet) above the introduction point of the O_2. This harsh reducing atmosphere is present in the gasifier throughout operation and provides for long residence times at high temperatures, ensuring complete breakdown of the RDF pellets and the reinjection stream of particulates, tars, oils, and other hydrocarbons fed into the unit.

Complicated organic materials, including polychlorinated biphenyls, trichlorobenzenes, polychlorinated dibenzodioxins, furans, perchloroethylene, and other industrial waste materials would also be broken down through the combination of high-temperature oxidation followed immediately by high-temperature reduction. The conditions present would be sufficient to break strong chemical ionic bonds, including the diatomic chlorine and carbon chlorine bonds. Dioxins, furans, and other recombination products would not exist as anything more than transient species at the temperatures present in the oxidation zone. Any formation of such materials in the oxidation zone would be completely broken down in the atmosphere within the reduction zone. The reducing zone also prevents formation of oxidized sulfur and nitrogen species such as SO_2 and NO_x. Sulfur is primarily converted to H_2S and, to a lesser degree, carbonyl sulfide (COS), while nitrogen is converted to diatomic nitrogen gas (N_2) and ammonia, with trace amounts

of hydrogen cyanide also present. Halogens, such as chlorine, are converted to their corresponding hydrogen halides rather than diatomic halogen, i.e., hydrogen chloride rather than chlorine gas. The reduced species, including H_2S, COS, ammonia, hydrogen cyanide, and hydrogen chloride, are easily and virtually completely removed from the raw syngas while it passes through the clean-up phase.

As the hot syngas rises from the partial oxidation zone at the bottom of the gasifier, through the reducing zone and higher within the unit, in a path opposite to the descending coal and RDF pellet feed stream, the syngas transfers some of its heat energy to the descending solid material. This cools the syngas to a temperature of approximately 427 to 538ºC (800 to 1,000ºF). Once this occurs, no additional reactions can take place in the reducing atmosphere and the syngas exits the gasifier where it is immediately quenched with water and begins the clean-up process. The transfer of heat from the raw syngas to the descending column of feed materials preheats the material, thus conserving energy and improving the overall efficiency of the system. As the feed materials heat up, water and low boiling organic materials are driven off. As the temperature of the material continues to rise, volatile oils and tars are driven off via a distillation and entrainment mechanism. The water, light hydrocarbons, oils and tars exit the unit with the raw syngas and are condensed and removed from the raw syngas by the downstream water quench and gas cooling units located within the cooling tower. Steam is also produced as the syngas enters the cooling tower as the syngas is cooled and purified by heat exchange. The conceptual process flow provided by KPE assumes a circulation rate of 75,000 liters (20,000 gallons) per minute within the tower. The organic liquid, oils, and tars are separated from the quench water and recycled back to the gasifier to undergo further conversion into syngas. This injection occurs via the O_2 and steam injection tuyeres at the bottom of the unit.

Though this process of driving off volatile matter is similar to the process by which charcoal is created, it is only a coincidental result of the process and not the ultimate pathway. Charcoal production is conducted at low temperatures in the relative absence of O_2 and results in a 25 to 30 percent yield of the original material and the potential for large waste streams, including air emissions. This portion of the BGL process differs because the condensed organic materials are captured and recycled back into the gasifier for complete conversion into syngas. These condensed materials are not considered a waste stream and there are no potential emissions of material to the environment.

This process is what differentiates BGL gasification from other gasifier technologies. Other methods of gasification, including entrained flow and slurry feed, only allow for one pass of all feed materials through the gasifier for conversion into syngas. The one-pass method results in lower thermal efficiencies since the feed material is not preheated, nor is the raw syngas cooled before it leaves the gasifier unit. The volatilization of oils and tars in the BGL process represents only a small portion of the feed material, yet it greatly increases the thermal efficiency of the BGL process in comparison to other gasification techniques, and the tars and oils are reinjected into the unit for conversion into syngas. The volatilization of oils and tars in the BGL unit occurs in the complete absence of O_2 and in a reducing environment, which eliminates the possibility of recombination reactions to form hazardous chemicals such as dioxins and furans. In the unlikely event that such chemicals were created, they would be condensed out in the water quench and downstream cleanup and ultimately be reinjected back into the unit (Vick 2001).

Along with the volatilization of tars and oils at the top of the feed column, high volatility metals come off of the feed and leave the gasifier unit with the raw syngas, while the low volatility metals continue descending with the feed column through the unit. Table 3.1-1 shows the partitioning percentage of each metal retained in the feed column and that comes off the feed column with the raw syngas. The metals that leave with the raw syngas form into metal sulfide solids, due to the chemical interaction with the sulfur in the raw syngas, in the downstream gas clean-up process. In the clean-up process, the tar and oil condensate stream is cooled to about 38°C (100°F), which ensures extensive condensation of the metals. These downstream metal solids are reinjected with the tar and oil feed through the tuyeres and the metals are ultimately retained in the glassy silica matrix of the vitreous frit. Limited quantities of the metals are retained in the process water of the quench water, as shown in Table 3.1-1. This water is separated from the tar and oil condensate reinjection feed and reused in the quench to provide further opportunity for retention of metals within the system (Global Energy 2001a).

Table 3.1-1. Metals Partitioning in a Typical Gasification System

	Metals	Vitreous Frit	Downstream Solids	Process Water
Low Volatility Metals	Cobalt	90%	10%	0%
	Copper	71%	29%	<0.3%
	Manganese	87%	8%	5%
	Nickel	88%	8%	4%
	Chromium	84%	12%	4%
	Vanadium	86%	9%	5%
High Volatility Metals	Arsenic	33%	63%	4%
	Lead	4%	96%	<0.2%
	Cadmium	4%	96%	<0.3%
	Mercury	0%	100%	0%
	Zinc	8%	92%	<0.2%
	Tin	36%	64%	0%

Source: Global Energy 2001a.

Table 3.1-2 shows the trace concentrations of metal in the process water and compares the concentrations to the limits established by the Toxicity Characteristic Leaching Procedure (TCLP) used by the U.S. Environmental Protection Agency (EPA). The process water is retained within the system and would not be directly discharged prior to treatment. During a typical treatment process, lime would be added to the water to condense any metals contained within. The concentrations of the different metals would be significantly reduced as the metals condense onto the lime. The lime would also be removed from the water prior to discharge. The only metal within the process water to exceed TCLP limits is selenium.

The last zone within the BGL gasification unit is located at the bottom of the unit and is the vitreous frit production zone. This zone is at the bottom of the partial oxidation zone, where the temperatures are high enough to melt any inorganic materials contained within the fuel feed column, including the RDF pellets and form a molten glassy material. This molten material collects in a pool below the hearth and is periodically removed via a taphole at the bottom of the pool. The material then drops into a water quench tank, where it cools at a high rate that causes it to shatter and form a black, glassy, sand-like material. Unlike the ash formed from incinerators, which is a hazardous waste due to its leachable nature, the vitreous frit from 100 percent coal-fed units has been shown to be nonleachable by EPA test protocols and can be marketed as a product. Should the frit from these gasifiers be nonleachable, it can be used without further processing in a number of areas, including road-building aggregate (Vick 2001).

Tables 3.1-3, 3.1-4, and 3.1-5 present the Ultimate and Mineral Analyses for a sample of frit from a commercial scale BGL gasifer operating on a 100 percent coal feed. Appendix E provides the results of an analysis for a full screen of the Universal Treatment Standards constituents. As the data shows, the test results are either nondetect or well below the criteria, which are more stringent than the TCLP criteria, indicating that the frit is benign. The trace elements presented in Table 3.1-5 are located within the silica matrix of the frit and, as shown in Appendix E, do not leach to any significant extent. Since this project would operate on a different feed than the project the frit sample came from, the first batch of frit generated by the project should undergo TCLP testing to ensure that the frit will be benign.

Sulfur Removal and Recovery

The sulfur compounds are removed from the raw syngas in two steps, acid gas cleanup and sulfur recovery. The acid-gas cleanup is generally accomplished by using a selective amine-type solvent. The sulfur recovery units use a process unit that employs a specific chemical reaction, called the Claus reaction, to generate elemental sulfur. The elemental sulfur in these compounds will be a co-product and sold commercially. The quantity of elemental sulfur generated would depend directly on the sulfur content of the coal used. The selection of a coal source will not be determined until after project financing is completed. A bounding scenario based on 50 percent coal feed and 4 percent sulfur in coal, which is the worst-case for

sulfur production, equates to approximately 90.7 metric tons (89.3 long tons) per day of elemental sulfur. The 33,100 metric tons (32,600 long tons) per year would be a minor addition to

Table 3.1-2. Typical Trace Metal Concentrations in Gasifier Facility Process Water

Metal	Concentration (ppm)	TCLP Limits (ppm)
Copper	<1.100	
Vanadium	<0.020	
Aluminum	3.190	
Cadmium	<0.100	1.0
Arsenic	3.900	5.0
Mercury	0.028	0.2
Molybdenum	<0.070	
Antimony	0.250	
Chromium	<0.100	
Nickel	0.970	
Cobalt	0.023	
Zinc	<0.400	
Selenium	2.060	1.0
Silver	<0.040	5.0
Lead	0.200	5.0
Manganese	1.200	
Beryllium	<0.010	

Source: Global Energy 2001a.
Note: ppm is parts per milion, TCLP is Toxicity Characteristic Leaching Procedure.

Table 3.1-3. Ultimate Analysis for the Frit Sample

Parameter	As Received (Percent of Total)	Dry Basis (Percent of Total)
Moisture	0.11	N/A
Carbon	0.21	0.21
Hydrogen	0.01	0.01
Nitrogen	0.05	0.05
Sulfur	0.42	0.42
Ash	99.20	99.31
Oxygen	0.00	0.00
Total	**100.00**	**100.00**

Source: Global Energy 2001b.

Table 3.1-4. Mineral Analysis for the Frit Sample

Parameter	Weight (Pecent of Total as Oxide)	Element	Weight (Percent of Total as Element)
Silica (SiO_2)	34.71	Silicon	16.23
Alumina (Al_2O_3)	24.41	Aluminum	12.92
Titania (TiO_2)	1.00	Titanium	0.60
Ferric Oxide (Fe_2O_3)	2.91	Iron	2.04
Calcium Oxide (CaO)	26.18	Calcium	18.71
Magnesia (MgO)	5.47	Magnesium	3.30
Potassium Oxide (K_2O)	0.71	Potassium	0.59
Sodium Oxide (Na_2O)	3.40	Sodium	2.52

Source: Global Energy 2001b.

Table 3.1-5. Trace Elements Found in the Frit Sample

Parameter	Concentration (microgram/gram)
Antimony (Sb)	< 4
Arsenic (As)	< 4
Beryllium (Be)	40
Boron (B)	1230
Cadmium (Cd)	< 2
Chloride (Cl)	580
Chromium (Cr)	290
Cobalt (Co)	17
Copper (Cu)	50
Fluoride (F)	< 20
Lead (Pb)	34
Manganese (Mn)	1140
Mercury (Hg)	0.03
Molybdenum (Mo)	< 20
Nickel (Ni)	45
Silver (Ag)	< 2
Thallium (Tl)	< 4
Vanadium (V)	530
Zinc (Zn)	3

Source: Global Energy 2001b.

annual domestic sulfur production, which was approximately 15.2 million metric tons (14.9 million long tons) in 1999. The majority of this, 13.1 million metric tons (12.9 million long tons), was produced by other energy companies in fuel refineries or natural gas exploration (ChemExpo 1999). The elemental sulfur produced by the Kentucky Pioneer IGCC Demonstration Project facility is similar to that produced by other energy companies, and is therefore readily marketable. The majority of the sulfur market, approximately 90 percent, is allocated to the development of sulfuric acid for fertilizer production (ChemExpo 1999). Liquid tankers are currently planned to transport the sulfur offsite; however, the choice of rail or truck transport will depend upon customer selection and their location.

The acid-gas clean-up process removes the sulfur compounds after the raw syngas has cooled. There are several technologies that can accomplish this process. Each process is based on the absorption of the sulfur into a selective amine-type solvent. The Kentucky Pioneer IGCC Demonstration Project facility would utilize an acid-gas clean-up process that is expected to achieve better than 99 percent sulfur removal, lowering the clean syngas sulfur to 40 parts per million or less H_2S. The specific acid-gas clean-up process has not yet been determined for the Kentucky Pioneer IGCC Demonstration Project. For example, the acid-gas clean-up technology could include the Purisol technology developed by Lurgi and the Selexol™ process developed by UOP, LLC (EIV 2000).

The acid-gas clean-up process consists of washing, absorption, stripping, and regeneration to remove sulfur and other contaminants from the syngas. The sulfur removal process absorbs sulfur compounds in a selective solvent. The removal of contaminants occurs in the absorber tower. The syngas will enter the bottom of the absorber and pass through a prewash section where naphtha, hydrogen cyanide, and other undesirable compounds are removed by washing with a portion of the solvent stream. The prewash solvent is circulated to a stripper and extractor where the contaminants are removed and recycled to the gasifier. The prewash syngas then enters the main wash section of the absorber in order to remove the H_2S. This section also contains COS hydrolysis trays to convert COS to H_2S to allow its removal. The H_2S-free syngas then enters the final, upper portion of the absorber and is washed by demineralized water to remove any solvent vapors remaining in the desulfurized syngas. The water-saturated syngas is then routed to the gas turbines through the preheat/saturation area.

The H_2S absorbed by the solvent in the absorber or reabsorber is removed by indirect steam stripping in the hot regenerator. The stripped H_2S is sent to the Claus Sulfur Plant and then the regenerated solvent is circulated back to the absorbers. The gas stream containing primarily H_2S generated in the acid-gas clean-up process is sent to the Sulfur Recovery Unit where the sulfur compounds are converted to elemental sulfur using the Claus reaction. The gas stream first reacts with air in a combustion chamber to produce sulfur dioxide (SO_2). Next, the gas is cooled and sent through the Claus reactors where a highly active aluminum oxide catalyst induces conversion to elemental sulfur. In addition, the gas undergoes a reaction known as the Claus reaction in which the SO_2 produced in the first step reacts with H_2S to produce elemental sulfur and water.

The gas would then pass through a hydrogeneration unit to convert all reduced sulfur back to H_2S to allow cleanup of the small fraction of remaining sulfur. The Kentucky Pioneer IGCC Demonstration Project would recycle the tail gas back to the gas clean-up plant so that there are no SO_2 emissions from the sulfur recovery process.

The gasifiers could be shut down or placed on standby quickly if there is a problem during the acid-gas clean-up process or the sulfur removal process. The removal of oxygen injection and solid fuel addition rapidly removes heat and allows isolation of the reactor and avoidance or minimization of any flare or vent release of raw syngas. The gasifiers are routed to an emergency flare in case of malfunction (EIV 2000). The primary stream constituent to the flare is syngas diluted with water and nitrogen (N_2). As stated previously, purified syngas is predominantly CO and H_2, with small amounts CO_2, methane, ethane, and sulfur present. These constituents and modern flare design generally result in CO, CO_2 and water as flare combustion products. Sulfur dioxide would result from the combustion of the relatively minor sulfur content. Raw syngas, before purification, would contain these main constituents and some heavier hydrocarbon compounds. Regulatory requirements accept that flares are essential components of safe plant design and account for potential flare combustion considerations in permit and non-permit requirements.

Synthesis Gas Feed

The raw syngas is routed through processing units that reduce the temperature; remove particulate matter, tars, oils, and other hydrocarbons that may have been carried into the hot syngas; and remove any contained hydrogen chloride, in addition to the sulfur removal and recovery process. The particulate matter, tars, oils, and other hydrocarbons are reinjected into the gasifier unit for further processing and conversion to syngas. Once these steps are completed, the cleaned syngas, comprised of 55 percent CO, 30 percent H_2, 10 percent CO_2, 5 percent methane and ethane, and trace amounts of H_2S, is used to fuel the gas turbines in the combined cycle power plant. Nitrogen and steam are blended into the cleaned syngas to dilute it, which provides further cooling of the gas to control and reduce NO_x emissions. The nitrogen and steam blend also provides a higher mass flow to the turbines, which results in more power generation.

In the event the gasifier would not be needed, it would be placed on standby or shutdown. The removal of O_2 injection and solid fuel addition rapidly removes heat and allows isolation of the reactor and avoidance or minimization of any flare or vent release of raw syngas (EIV 2000).

3.1.2.3 Supporting Project Facilities

The supporting project facilities would include administrative offices, railcar loading and unloading areas, on-site utilities, steam-generating units, air emissions control equipment, and wastewater treatment equipment. The existing water intake structure located in the Kentucky River would also be modified to accommodate the additional water requirements of the facility.

Though detailed design has not been initiated, KPE has indicated that all of these supporting facilities, with the exception of the administrative offices and railcar loading and unloading areas, would be incorporated into the 4.8-hectare (12-acre) main power island facility, and are included under both No Action

Alternative 2 and the Proposed Action. Administrative offices are housed in existing buildings owned by EKPC on the site and are leased by KPE. Rail loading and unloading areas required for the Proposed Action would be integrated into the balance of the plant for optimal layout of the site and utilization of the process area.

3.1.3 Project Risk

The proposed Kentucky Pioneer IGCC Demonstration Project would be a demonstration of a new technology under the CCT Program. Congress directed DOE to pursue the goals of the program by means of partial funding, or cost sharing, of projects owned and controlled by non-federal government sponsors. This project was first selected in 1993, with Duke Energy as the participant in partnership with an east coast utility; however, for various reasons the siting for the project was changed to a site in Illinois. In 1999, Global Energy, Inc., approached Duke Energy and requested to take over the project. KPE, a subsidiary of Global Energy, Inc., entered into a power purchase agreement with EKPC to buy the power from the Kentucky Pioneer IGCC facility. Because the currently proposed site for the project would provide for demonstration of the BGL technology and the power purchase agreement between EKPC would allow KPE to meet their repayment agreement with DOE, the partnership was determined acceptable.

The proposed facility would be the first commercial-scale demonstration of a co-fed BGL gasifier in the United States. The gasifier units used would also be between 40 and 50 percent larger than other existing units, allowing for greater syngas and electrical output from the facility. Because it would be the first demonstration of this technology, there would be a fair amount of financial risk for KPE associated with the operation of the facility. Another major financial risk for KPE is in securing a market for the vitreous frit produced in the gasification process. In addition to the loss of income if a market for the frit is not secured, KPE would have to bear all financial costs from storing and/or landfilling the frit. Although frit produced by gasification of coal has been found not to leach, frit resulting from the co-feed of coal and RDF has not been produced and therefore no leaching data is available. If the frit from the Kentucky Pioneer IGCC Demonstration Project is found to leach, it would not be marketable and the costs to temporarily store and landfill the frit would escalate significantly. Consequently, the financial success of the project is also dependant on the frit being deemed nonhazardous.

3.2 Fuel Source

The solid fuel source for the Kentucky Pioneer IGCC Demonstration Project would be high-sulfur coal and RDF pellets. RDF pellets would be procured from an RDF pellet manufacturer. The two fuel sources would be shipped by rail directly to on-site storage. At least 50 percent of the feed would consist of high-sulfur coal from the Kentucky region during the 1-year demonstration period (Global Energy 2000b).

3.2.1 Coal

KPE intends to use high-sulfur coal as the coal fuel co-feed; it will be procured for direct delivery to the project site. Western Kentucky coal is generally considered the high-sulfur coal region; however, Eastern Kentucky may also provide high-sulfur coal supplies. Project economics would determine the supplier and the type of coal supplied (Global Energy 2000b). The facility would require approximately 2,268 metric tons (2,500 tons) per day of coal, which equates to about 25 railcars per day. Compared to conventional coal-fired electric generation technologies, this project would require less coal consumption to generate 540 MW.

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3.2.2 Refuse Derived Fuel Pellets

The RDF pellets would be procured from an existing manufacturer. RDF pellets vary in size and are typically extruded into a uniform dense shape that makes them well suited to transportation and storage. Typical sizes would be small cylinders in the 1.27 centimeter (0.5 inch) by 7.62 centimeter (3 inch) range, or 3.81 centimeter (1.5 inch) square by 10.16 centimeter (4 inch) long blocks. The bulk density of RDF pellets is approximately 640 kilograms per cubic meter (40 pounds per cubic foot). By comparison, the bulk density of bituminous coal is approximately 801 kilograms per cubic meter (50 pounds per cubic foot) and a 50-50 mix of coal and RDF by weight would be equivalent to a 44-56 mix of coal and RDF by volume (Global Energy 2000b).

The Kentucky Pioneer IGCC Demonstration Project facility will convert the RDF pellet and coal feed into a syngas fuel through a chemical process conducted in a low oxygen atmosphere. The syngas fuel will then be combusted to generate the electrical output from the plant. Though the RDF pellets themselves will not be directly combusted, the facility would be regulated as a Municipal Waste Combustor under EPA guidelines established by 40 *Code of Federal Regulations* (CFR) Part 60. Chapter 6, Statutes, Regulations, Consultations, and Other Requirements, of this EIS discusses the applicability of these guidelines to the Kentucky Pioneer IGCC Demonstration Project facility.

3.2.2.1 Pellet Manufacturers

Historically, the waste-to-energy industry has used RDF pellets as a means of assuring effective co-feeding at conventional power plants. A wide variety of RDF pellet manufacturers and RDF pellet products exist. RDF pellets from sewage sludge are also produced to facilitate effective use of the energy content of this material in a generally dry form (Global Energy 2000b). KPE intends to obtain all RDF pellets from one supplier and is in the initial stages of contract negotiations with an RDF supplier located on the east coast of the United States.

3.2.2.2 Refuse Derived Fuel Pellet Production

RDF is manufactured in a process that includes controlled steps for the processing of MSW or common household waste. Initially, sorting of the MSW removes obvious large objects, also known as white goods (e.g. refrigerators). These continue on to the landfill and amount to 5 to 10 percent of the original weight of the MSW. Cans are then removed either magnetically, or for aluminum cans, by eddy current technology. Glass is removed by gravity. These are sent to recycling units and amount to a further 5 to 10 percent of the original weight. The intent of the process is to retain items with high thermal value, such as plastics and, to a lesser extent, paper. Processing methods vary, but most of the balance is then often tumbled in a long rotary drum that might be envisioned as a pressure cooker. With steam and air insertion rates used to control the temperature and moisture of the RDF product, a sterile "mulch type material" will result. Clumps of plastic are screened out for shredding or separate handling. The energy content of plastics is well suited for the gasification process. If shredded, the plastic component can be included in the RDF pellets. Otherwise, plastic material could be fed into the gasifier separately or simply recycled conventionally. Hammer mills and trundles are typically used to reduce the MSW to a small uniform size and homogeneous mixture. The sterile mulch is then formed into dense pellets by being forced through a mold at high pressures. The exact forming process is dependant upon handling considerations and the feed performance requirements of the gasification process. Being made with relatively low moisture content, RDF pellets are stable and durable. The process results in pellets with a relatively uniform size and shape and a generally uniform energy content. RDF pellets also have a relatively low ash content and good handling and storage life before use (Global Energy 2000b).

KPE requested a determination from the Kentucky Natural Resources and Environmental Protection Cabinet regarding the applicability of solid waste statutes and administrative regulations to the RDF pellets. The Kentucky Department of Environmental Protection, Division of Waste Management issued its decision in a letter dated June 27, 2002 . Based on the characterization of the process supplied by KPE and described

above, the recyclable material would be removed and the remaining material, about 70 percent paper and 10 percent plastics, would be mixed with binders and formed into pellets. In the June 27, 2002, letter, the Division of Waste Management states that the finished product would be typical for most RDFs and determines that the material would be an RDF under Kentucky statutes and administrative regulations.

Different RDF pellet manufacturing processes may result in slightly different RDF pellet compositions. The variation in RDF pellet composition due to different manufacturing processes should not be an issue for this project since KPE intends to supply all RDF pellets for this project from the same manufacturer. In the event other suppliers are used, there may be a slight change in the composition of the vitreous frit from the gasifier unit but the resulting syngas makeup should remain the same.

The Division of Waste Management also determined that the RDF is a recovered material and that the Kentucky Pioneer IGCC Demonstration Project facility would be considered a recovered material processing facility under state law. This determination means that no waste permit is needed for the gasification process and is dependent on KPE using RDF that conforms to the statutory definition of RDF established in Kentucky Revised Statutes 224.01-010(23). The Division of Waste Management has required KPE to submit a description of the selected RDF manufacturing process to the Kentucky Natural Resources and Environmental Protection Cabinet at least 30 days before beginning gasification to ensure that no changes to the RDF have been made from this determination and that the RDF meets the statutory definition.

The Division of Waste Management asserts that this determination does not release KPE from properly handling, storing, and disposing of all waste generated by the facility. As stated above, a hazardous waste determination must be conducted on the vitrified frit and other waste streams in accordance with Title 401, Kentucky Administrative Regulations, Chapters 31 and 32, specifically Chapter 32, Subpart 010, Section 2. The TCLP for metals would be administered to the first batch of frit from the facility to determine if it were hazardous.

3.2.2.3 Refuse Derived Fuel Transport

RDF pellets are a high density, stable product of uniform size. The pellets are amenable to bulk handling and shipping without undue fragmentation and loss. Large volume shipping would most likely use inter-modal rail (Global Energy 2000b). Should negotiations prove successful with the intended supplier, the RDF pellets would be shipped from a manufacturer on the east coast of the United States. The estimated transit distance is 1,609 to 1,931 rail kilometers (1,000 to 1,200 rail miles). The facility would require about 2,500 TPD of RDF, which equates to approximately 25 rail cars per day. For planning purposes, KPE assumes unit train handling of the RDF pellets. One unit train consists of 100 rail cars. This results in approximately two unit trains of RDF pellets per week of operation and approximately 100 unit trains of RDF pellets for the complete 1-year demonstration period of the project.

3.2.3 Synthesis Gas

Section 3.1.2 details the production of syngas in the Kentucky Pioneer IGCC Demonstration Project facility. Gasification technology is known to produce a very consistent syngas product, regardless of the variability of the feed. Though the RDF pellet composition is expected to be relatively constant, slight variations in the composition would have no effect on the composition of the syngas produced. The resulting syngas is expected to be 55 percent CO, 30 percent H_2, 10 percent CO_2, 5 percent methane and ethane, with a relatively small amount of sulfur in the form of H_2S.

3.3 Fuel Source Considered But Eliminated

The following fuel source was considered in the process of identifying the Proposed Action, but was found not to be a reasonable option because it poses significant disadvantages relative to the Proposed Action and no compensating advantages.

3.3.1 Briquette Facility

The *Notice of Intent to Prepare an Environmental Impact Statement for the Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project, Trapp, KY*, published in the *Federal Register* on April 14, 2000, indicated that a fuel production facility would provide the project with fuel briquettes made from high-sulfur coal and solid renewable fuels such as MSW. The briquette facility would have been built at an off-site location and the briquettes would have been shipped by rail to on-site storage for use as a fuel source. Since the publication of the Notice of Intent, KPE has determined that using briquettes produced from a mixture of coal and MSW is not a practical alternative. Rather, KPE proposes co-feeding coal and commercially obtained RDF pellets.

In comparison with a briquette facility, co-feeding coal and RDF pellets would provide the following advantages to the Kentucky Pioneer IGCC Demonstration Project:

- RDF pellets reduce capital and operating costs.
- RDF pellets significantly reduce transportation costs.
- RDF pellets have undergone extensive processing and are generally more innocuous than raw MSW.

3.4 Alternatives Analyzed

NEPA requires that agencies evaluate the reasonable alternatives to the Proposed Action in an EIS. The purpose for agency action determines the range of reasonable alternatives. The goals of the proposed agency action establish the limits of reasonable alternatives. Congress established the Clean Coal Technology (CCT) Program with a specific purpose: to demonstrate the commercial viability of technologies that use coal in more environmentally benign ways than conventional coal technologies. Congress also directed DOE to pursue the goals of the legislation by means of partial funding (cost sharing) of projects owned and controlled by non-federal government sponsors. This statutory requirement places DOE in a much more limited role than if the federal government owned and operated the project. In the latter situation, DOE would be responsible for a comprehensive review of reasonable alternatives for siting the project. However, in dealing with an applicant, the scope of alternatives is necessarily more restricted because the agency must focus on alternative ways to accomplish its purpose that reflect both the application before it and the functions the agency plays in the decision process. It is appropriate in such cases for DOE to give substantial consideration to the applicant's needs in establishing a project's reasonable alternatives.

The range of reasonable alternatives to be considered in the EIS for the proposed Kentucky Pioneer IGCC Demonstration Project was determined in accordance with the overall NEPA strategy. The EIS includes an analysis of the No Action Alternative, as required under NEPA. KPE has stated that the site would be used to construct a natural gas-fired combined cycle plant should DOE decide against providing cost-shared funding for the gasification technology demonstration, and therefore, two No Action Alternatives will be addressed. No Action Alternative 1 assumes that DOE decides against providing cost-shared funding for the project and that no plant is constructed as a result. No Action Alternative 2 assumes that DOE decides against providing cost-shared funding for the project and that KPE constructs a natural gas-fired combined-cycle plant, the power island portion of the overall project without the gasification component, at the proposed project location. In addition, the EIS analyzes the Proposed Action, which includes engineering and design, permitting, fabrication and construction, testing, and demonstration of the gasification technology, and the operation of the power island on the generated syngas.

Because of DOE's limited role of providing cost-shared funding for the proposed Kentucky Pioneer IGCC Demonstration Project, the EIS does not evaluate alternative sites for the proposed project. Site selection was governed primarily by benefits that KPE could realize. KPE selected the proposed previously-disturbed project site because the costs would be much higher and the environmental impacts would likely be greater if an undisturbed area were chosen.

3.4.1 No Action Alternatives

The Council on Environmental Quality (CEQ) NEPA Regulations (40 CFR Parts 1500-1508) and the DOE NEPA Regulations (10 CFR 1021) require the analysis of a No Action Alternative. Under the No Action Alternative, DOE would not provide partial funding for the design, construction, and operation of the Kentucky Pioneer IGCC Demonstration Project. This EIS considers two actions should this occur.

3.4.1.1 No Action Alternative 1

No Action Alternative 1 assumes that DOE decides against providing cost-shared funding for the project and that no plant is constructed as a result. This will result in no change in environmental impacts since it assumes that no plant would be built. DOE believes this scenario is unlikely to occur but it is presented because it serves as an analytical baseline for comparison of the environmental effects of the project.

3.4.1.2 No Action Alternative 2

No Action Alternative 2 assumes that DOE decides against providing cost-shared funding for the project and KPE constructs a natural gas-fired combined-cycle plant, the power island portion of the overall project, at the proposed project location. This alternative includes all associated facilities required for the operation of the power island, including administrative offices, on-site utilities, steam-generating units, required air emissions control equipment, wastewater treatment equipment, and the modification of the existing water intake structure. Siting for the foundation of the two combined cycle generator units would be within the 4.8-hectare (12-acre) plant site. All water for the plant would be supplied from existing EKPC intake structures at the J.K. Smith Site. The EKPC transmission line described in Section 3.1 would be required to support this action. The changes in the environment resulting from the operation of the power island are presented in the appropriate sections of Chapter 5, Environmental Impacts, and provide a basis for comparison with the impacts of the Proposed Action.

3.4.2 Proposed Action

Under the Proposed Action, DOE would provide, through a Cooperative Agreement with KPE, financial assistance for the design, construction, and operation of the proposed Kentucky Pioneer IGCC Demonstration Project. All associated facilities for the power and gasification islands, including fuel storage, rail car unloading sites, and air emissions control equipment, for the gasification technologies will also be constructed under the Proposed Action together with two syngas-fired combined cycle electric generation units and the transmission line. The proposed facility would be designed for at least 20 years of commercial operation and the CCT Program demonstration would operate for at least the first year. The proposed project would cost $414 million, of which DOE's share would be approximately $60 million, or 15 percent.

The proposed project includes the design, construction, and operation of the modified BGL gasification technology and associated facilities to provide a fuel source for the two planned turbines. Under the Proposed Action, the turbines would be fired using the syngas product generated by the gasification technology. The facility would demonstrate the following innovative technologies: (1) gasification of RDF pellets and coal; and (2) use of a syngas product as a clean fuel in combined cycle turbine generator sets. This project would be the first commercial-scale application of this modified co-feed version of the BGL gasification technology in the United States. The important modification to the BGL technology is the gasification of a blend of coal and RDF pellets. The demonstration would operate for at least the first year of the facility's 20-year commercial operational period. Data generated during the 1-year demonstration would be used to determine if the coal and RDF pellet co-feed would continue after the first year of operation.

The purpose of the proposed project is to generate technical, environmental and financial data from the design, construction, and operation of the facilities at a scale large enough to allow the power industry

to assess the potential of BGL gasification technologies for commercial application. If the project succeeds in generating this data, it would demonstrate that IGCC power plants, based on this technology, could be built cost effectively, with thermal efficiencies that would significantly reduce electric power costs over more conventional technologies.

3.5 Preferred Alternative

CEQ NEPA regulations require that an agency identify its preferred alternative, if one or more exists, in a Draft EIS and identify such an alterative in the Final EIS (40 CFR 1502.14 [e]). The preferred alternative is the alternative that DOE believes would fulfill its statutory missions and responsibilities giving consideration to economic, environmental, technical and other factors. This Kentucky Pioneer IGCC Demonstration Project Final EIS provides information on the potential environmental impacts. Cost, schedule, and technical analyses are also being prepared and will be considered in the DOE ROD.

DOE's preferred alternative (the Proposed Action) is to provide cost-shared funding to KPE through their Cooperative Agreement for the design and construction of the Kentucky Pioneer IGCC Demonstration Project under the CCT Program. The ROD will describe DOE's decision regarding whether to provide the $60 million in cost-shared funding.

3.6 Comparison of Alternatives

Table 3.6-1 reflects a comparison of alternatives at the project site under the two No Action Alternatives and the Proposed Action. This brief comparison of impacts is presented to aid decisionmakers and the public in understanding the environmental impacts of proceeding with the Kentucky Pioneer IGCC Demonstration Project.

The following discussion is based on the detailed information presented in Chapter 5, Environmental Impacts. The environmental impact analyses were designed to produce a credible projection of the potential environmental impacts, using conservative assumptions and analytical approaches. A detailed discussion of the level of conservatism and any uncertainties in these analyses is presented in Chapter 5. Impacts presented are for each alternative alone and are not cumulative; however, comparisons of impacts for the different alternatives are made at points within Table 3.6-1.

Table 3.6-1. Comparison of Alternatives

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Land Use	No new land disturbance would occur at the project site location. Mitigation: None anticipated.	Disturb approximately 121 hectares (300 acres) of previously disturbed land for project construction activities. The process area will occupy approximately 4.8 hectares (12 acres). No effects on surrounding land uses or local land use plans or policies are expected. Mitigation: None anticipated.	Disturb approximately 121 hectares (300 acres) of previously disturbed land for project construction activities. The process area and storage facilities will occupy approximately 7.6 hectares (19 acres). No effects on surrounding land uses or local land use plans or policies are expected. Mitigation: None anticipated.
Socioecomonics	No increase in new employment or workers would be expected. The employment and population in the region of influence (ROI) would remain the same. Mitigation: None anticipated.	Construction would generate approximately 120 jobs during the six-month construction phase with peak employment reaching 200 workers. Additional indirect employment of 138 to 230 jobs would be created based on the duration of peak construction levels. The 20-year operation period would require 24 workers and indirectly create an additional 54 jobs. There would likely be no change to the level of community services provided in the ROI. Mitigation: None anticipated.	Construction would generate approximately 600 jobs during the 30-month construction phase with peak employment reaching 1,000 workers. Additional indirect employment of 690 to 1,150 jobs would be created based on the duration of peak construction levels. The 20-year operation period would require 120 workers and indirectly create an additional 270 jobs. Population may increase in the ROI, but no impact is expected in the level of community services provided. In areas near the plant, property values may decline slightly. Mitigation: None anticipated.
Cultural Resources	No impacts to cultural resources would occur at the project site location. Mitigation: None anticipated.	The Section 106 Review process for the Area of Potential Effect has been completed. The Kentucky State Historic Preservation Officer finds that there is not effect on historic properties. Mitigation: If resources are encountered during construction, procedures planned by Global Energy, Inc., would be followed upon discovery. Should any discoveries occur, the Kentucky State Historic Preservation Officer (SHPO) would be notified and construction in the area would cease until a qualified archaeologist could evaluate the findings and SHPO concurrence was obtained.	The Section 106 Review process for the Area of Potential Effect has been completed. The Kentucky State Historic Preservation Officer finds that there is not effect on historic properties. Mitigation: If resources are encountered during construction, procedures planned by Global Energy, Inc., would be followed upon discovery. Should any discoveries occur, the Kentucky State Historic Preservation Officer (SHPO) would be notified and construction in the area would cease until a qualified archaeologist could evaluate the findings and SHPO concurrence was obtained.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Aesthetic and Scenic Resources	The existing project site location visual setting would not change, nor would area scenic resources be affected. Mitigation: None anticipated.	The combined cycle units would not be visible from outside of the site area. No visible plumes are associated with the combined cycle units. Fugitive dust during construction may temporarily affect visibility. Mitigation: Standard dust control measures would be implemented. Additional mitigation is not anticipated.	The combined cycle units would not be visible from outside of the site area. No visible plumes are associated with the combined cycle units. Fugitive dust during construction may temporarily affect visibility. The gasifier facility stacks and plumes would likely be visible from the City of Winchester, the community of Trapp, and the Pilot Knob State Nature Preservation. Fugitive dust during construction may affect visibility temporarily. Mitigation: Standard dust control measures would be implemented. Additional mitigation is not anticipated.
Geology	No impacts to geology or geologic resources would occur at the project site location. Mitigation: None anticipated.	Minor impacts on the geology and geologic resources due to disturbances associated with construction, parking, and construction laydown areas are expected, however, the site has been previously graded. Mitigation: Runoff and erosion controls, dust controls, and reuse of stockpiled soil.	Minor impacts on the geology and geologic resources due to disturbances associated with construction, parking, and construction laydown areas are expected, however, the site has been previously graded. Slightly greater impacts to prime farmland soils than No Action Alternative 2 are expected from the construction of additional support facilities. Mitigation: Runoff and erosion controls, dust controls, and reuse of stockpiled soil.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Air Resources	No impacts to air resources would occur at the project site location. Mitigation: None anticipated.	Increases in annual air emissions of NO_x, SO_x, PM_{10}, and reactive organic gases (ROG) would result from the facility. The highest emissions would be in the form of NO_X (approximately 1,100 TPY), CO (approximately 800 TPY), and SO_X (approximately 500 TPY). The facility would also emit approximately 2.1 million TPY of CO_2. Pollutant emissions and levels would be well within applicable standards. No significant air quality impacts are expected from facility operation. Mitigation: Emission control equipment would be included in facility design.	Increases in annual air emissions of NO_x, SO_x, PM_{10}, and ROG would result from the facility. The highest emissions would be in the form of NO_X (approximately 1,100 TPY), CO (approximately 800 TPY), and SO_X (approximately 500 TPY). An increase in PM_{10} emissions of approximately 15 percent over No Action Alternative 2 would occur. NO_x and PM_{10} would approach PSD Significant Impact level thresholds for annual average levels. PM_{10} would also approach the 24-hour threshold. Hazardous air pollutant emissions would increase by 9.07 TPY. The facility would also emit approximately 2.1 million TPY of CO_2. Pollutant emissions and levels would be well within applicable standards. No significant air quality impacts are expected from facility operation. Mitigation: Emission control equipment would be included in facility design.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Water Resources	No impacts to water resources would occur at the project site location. No activities would occur that could potentially affect wetlands and surface waters. Mitigation: None anticipated.	The facility would require 3.8 MLD (1 MGD) of surface water from the Kentucky River. Project operations would generate less than 1.5 MLD (0.4 MGD) of wastewater. Treated wastewater would be discharged to the Kentucky River in compliance with the site-specific Kentucky Pollutant Discharge Elimination System (KPDES) permit, resulting in negligible impacts. During 7-day low flow conditions, the facility would withdraw 1 percent of the flow of the Kentucky River. No use of or discharge into groundwater resources during construction or operation would occur. Mitigation: None anticipated beyond project design, including permit requirements, and administrative controls.	The facility would require a total of 15.1 MLD (4 MGD) of surface water from the Kentucky River. Project operations would generate 1.5 MLD (0.4 MGD) of process wastewater. Treated wastewater would be discharged to the Kentucky River in compliance with the site-specific KPDES permit, resulting in negligible impacts. The other 13.6 MLD (3.6 MGD) of surface water is used in the operation of the gasifier, turbine condenser, and fuel gas saturation process, as well as other miscellaneous uses. During 7-day low flow conditions, the facility would withdraw 1 percent of the flow of the Kentucky River. In order to minimize potential conflicts over water availability during low flow conditions, the State of Kentucky limits permitted users to no more than 10 percent of the lowest average monthly flow. This requirement applies to EKPC's existing permit, which would likely be modified to incorporate the additional withdrawals associated with the Proposed Action. No use of or discharge into groundwater resources during construction or operation would occur. Mitigation: None anticipated beyond project design, including permit requirements, and administrative controls. Although not a condition of the permit, during extremely low flow conditions for the Kentucky River, KPE has stated that it would work with the Division of Water and cease plant operations if requested.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Ecological Resources	There is no potential to affect federally-listed plant and animal species, or species identified by other federal and/or state agencies at the project site location. Mitigation: None anticipated.	Since no federal- or State-listed protected, sensitive, rare, or unique species have been identified at the project site location, no impacts would be expected. In addition, the proposed site location does not contain suitable habitat for the federally endangered running buffalo clover. Approximately 4.8 hectares (12 acres) of old-field vegetation and habitat would be lost from construction of the proposed facility. Mitigation: Post-construction mitigation landscaping consisting of a control program for non-native invasive plants should be adopted.	Since no federal- or State-listed protected, sensitive, rare, or unique species have been identified at the project site location, no impacts would be expected. In addition, the proposed site location does not contain suitable habitat for the federally endangered running buffalo clover. Approximately 7.6 hectares (19 acres) of old-field vegetation and habitat would be lost from construction of the proposed facility and support structures. Mitigation: Post-construction mitigation landscaping consisting of a control program for non-native invasive plants should be adopted. Due to the height of the emissions stacks, the Federal Aviation Administration will require stack lighting. To minimize bird strike mortality, the USFWS has developed a set of voluntary recommendations for tower siting, construction, operation, and decommissioning. The gasifier stacks lighting system would be designed in consideration of USFWS recommendations.
Noise	No noise impacts would occur since no construction activities would be taking place. Mitigation: None anticipated.	Short-term minor increase in noise during construction and operation. Vehicle traffic would cause minor noise increases over background levels in the community of Trapp. Mitigation: None anticipated.	Short-term minor increase in noise during construction and operation. Vehicle and rail traffic would cause minor noise increases over background levels in the community of Trapp. Mitigation: None anticipated.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Traffic and Transportation	No adverse traffic or transportation impacts. Mitigation: None anticipated.	Increase in road traffic from construction and operation of facility. Depending on the level of construction activity occurring onsite, 100 to 200 vehicle trips per shift change would occur. Approximately 40 to 60 heavy duty truck trips per day would be made to and from the project site. Railcars would move heavy equipment to the site during construction as needed. Approximately 48 vehicle trips per day would be made during operation, all utilizing Kentucky Highway 89. No railcars would be required for operation. Mitigation: KPE should install turning lanes or traffic control devices (i.e., stop lights) at the intersection of Kentucky Highway 89 and the facility service road.	Increase in traffic associated with construction. Approximately 500 to 1,000 vehicle trips per shift change, depending on the level of construction occurring, and 40 to 60 heavy-duty truck trips per day would be made to and from the project site. Traffic congestion may be heavy at times during afternoons when school buses operate along Kentucky Highway 89. Railcars would move heavy equipment to the site during construction as needed. Approximately 160 to 240 additional vehicle trips throughout each day would be made all utilizing Kentucky Highway 89 during operation. Approximately one unit train (100 rail cars) movement would be made in or out of site per day during facility operation. Existing rail infrastructure onsite is sufficient to accommodate a full unit train. Mitigation: Worker transportation options such as car pooling should be considered. KPE should install turning lanes or traffic control devices (i.e., stop lights) at the intersection of Kentucky Highway 89 and the facility service road. Implementation of directional controls for the service road should also be considered. KPE agrees to repair roads damaged by facility truck traffic.
Occupational and Public Health and Safety	No occupational and public health and safety impacts. Mitigation: None anticipated.	Typical worker impacts present in the construction industry would be associated with facility construction. No significant occupational or public health and safety impacts are expected during facility operation. All noise and health impacts would be mitigated using typical industry safety measures. Mitigation: Typical industry safety measures would be implemented.	Typical worker impacts present in the construction industry would be associated with facility construction. No significant occupational or public health and safety impacts are expected during facility operation. All noise and health impacts would be mitigated using typical industry safety measures. Mitigation: Typical industry safety measures would be implemented.

Discipline	No Action Alternative 1	No Action Alternative 2 (Power Island)	Proposed Action (Power and Gasification Islands)
Waste Management	No change to existing facility services within the J.K. Smith Site. Mitigation: None anticipated.	Facility construction and operation would generate small quantities of hazardous and nonhazardous wastes and waste water. Mitigation: Typical industry measures would be implemented to minimize waste generation. Hazardous wastes would be disposed in approved hazardous waste landfills outside of Kentucky.	Facility construction would generate small quantities of hazardous and nonhazardous wastes and wastewater over the 30-month construction period. Operation would generate larger quantities of wastewater and hazardous wastes than No Action Alternative 2. The gasifiers would produce large quantities of vitrified frit and elemental sulfur, which KPE expects would be marketable. Mitigation: Typical industry measures would be implemented to minimize waste generation. Hazardous wastes would be disposed in approved hazardous waste landfills outside of Kentucky. Should the vitrified frit be shown to be hazardous, it would also be disposed in approved hazardous waste landfills.

Note: MGD = million gallons per day; TPY = tons per year; MLD = million liters per day; USFWS=U.S. Fish and Wildlife Service.

4. AFFECTED ENVIRONMENT

4.1 Introduction

This chapter describes the existing environment at the proposed site for the Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project. Specific site information for this environmental impact statement (EIS) was obtained and referenced primarily from the *Final Environmental Impact Statement J.K. Smith Power Station Units 1 and 2 and Associated Transmission Facilities* (J.K. Smith EIS) (REA 1980) and the *Kentucky Pioneer Plant Environmental Information Volume* (EIV) (EIV 2000). The EIV was prepared by Kentucky Pioneer Energy (KPE), LLC, to assist in the U.S. Department of Energy's (DOE) consideration of the Kentucky Pioneer IGCC Demonstration Project as part of the Clean Coal Technology (CCT) Program. The two documents discussed in Section 1.4 of this EIS, the *J.K. Smith Power Station Units 1 and 2 Clark County, Kentucky Environmental Analysis* and the *Combustion Turbine Generation Project Environmental Assessment* were also used to develop this chapter. Where necessary, updated environmental baseline information is presented and documented accordingly.

4.2 Land Use

This section describes the existing and planned land use at the proposed Kentucky Pioneer IGCC Demonstration Project site.

The Kentucky Pioneer IGCC Demonstration Project will be located within a 121-hectare (300-acre) tract of land owned by the East Kentucky Power Cooperative (EKPC) in Clark County, Kentucky. The 121 hectares (300 acres) are located within a 1,263-hectare (3,120-acre) tract owned by EKPC, known as the J.K. Smith Site. The tract is 34 kilometers (21 miles) southeast of the city of Lexington, 13 kilometers (8 miles) southeast of the city of Winchester, and 1.6 kilometers (1 mile) west of Trapp, Kentucky (see Figure 3.1-1).

The project site can be accessed through a gated perimeter fence and an access road off of Kentucky Highway 89. The access road is approximately 1.6 kilometers (1 mile) from Kentucky Highway 89 to the project site (see Figure 3.1-7). Plant access by rail, which crosses the eastern side of the station, will be from the freight rail line owned by CSX Transportation, Inc.

The 1,263-hectare (3,120-acre) tract is located within the Kentucky River Basin. The site is a hilly highland bounded by the Upper Howard Creek on the north and west, the freight rail line on the east, and the Kentucky River on the south. The project area will consist of a 121-hectare (300-acre) tract of land previously graded during site preparation for the abandoned construction of the J.K. Smith Power Station by EKPC. The process area will cover approximately 4.8 hectares (12 acres) of the 121-hectare (300-acre) tract of land.

The J.K. Smith Site lies within the jurisdiction of the Winchester-Clark County Planning Commission, which provides uniform direction through their Comprehensive Plan and Zone Ordinance. The project site lies within the unincorporated portion of Clark County. This area is planned to remain rural and is zoned "agricultural." The utility structures within the J.K. Smith Site are eliminated from zoning procedures because the Planning Commission does not consider utility structures in determining zoning for an area. Therefore, the three combustion turbines (CTs) at the site and the previously disturbed areas from construction in the 1980s have not affected the current zoning within the J.K. Smith Site. The three gas CTs, owned by EKPC, are located on approximately 19 hectares (48 acres) of land outside of the project site. These turbines are located approximately 0.8 kilometers (0.5 miles) west of the proposed 121-hectare (300-acre) site.

The primary land uses for a site zoned "agricultural" are cropland and pasture. Because the J.K. Smith Site is a private site, owned and operated by EKPC, there are no current farming practices occurring onsite. There are no commercial or community facilities onsite. The industrial uses within the J.K. Smith Site include a natural gas field, with four producing gas wells, two nonproducing gas wells, and five natural gas pipelines owned by Tennessee Gas Pipeline Company. The predominant land uses within 8 kilometers (5 miles) of the project site are cropland and pasture, forest, and shrub/brush rangeland. Several small residential areas surrounding the perimeter of the J.K. Smith Site are zoned residential.

The proposed route for the 138-kilovolt (kV) line extends northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky, where it will interconnect with the existing local power grid. The proposed new transmission line would be approximately 27 kilometers (17 miles) in length; however, the exact route for the line has yet to be determined. The terrain is typified by gently rolling hills and the land cover is predominately agricultural.

4.3 Socioeconomics

This section describes current socioeconomic conditions within a region of influence (ROI) where the majority of the Kentucky Pioneer IGCC Demonstration Project workforce is expected to reside, based on proximity to the site and historic employment patterns. The ROI is a three-county area in Kentucky comprised of Clark, Fayette, and Madison Counties (Figure 4.3-1). The ROI covers an area of 2,538 square kilometers (980 square miles) around the project site (Census 1994).

The ROI established is only applicable for this resource area and the traffic and transportation study. Social and economic impacts are distributed over a wider area, which is reflected in the selection of a comparatively larger area of analysis. The larger area is due to the fact that individuals who travel from as far away as Lexington, for example, to work on the site will not use their disposable income solely within Clark County. Rather, they would spend most of it closer to their homes. This is where the economic impact would be experienced.

4.3.1 Employment and Income

Fayette County is primarily urban and is comprised of the city of Lexington. The remaining counties in the ROI are largely rural in character. Employment by sector over the last decade has changed slightly, as shown in Table 4.3-1. The service sector provides the highest percentage of the employment in the ROI, almost 30 percent, followed closely by the wholesale and retail trade and government sectors, with 23 percent and 16.3 percent, respectively. Farm employment has decreased over the last decade, providing 2.9 percent of employment in 1990 but only 2.2 percent in 1997 (BEA 1999). Table 4.3-1 presents employment levels for the major sectors of the ROI economy.

Table 4.3-1. Employment By Sector (Percent)

Sector	1990	1997
Services	26.4	29.8
Wholesale and Retail Trade	22.3	23.0
Government and government enterprises	17.8	16.3
Manufacturing	12.5	11.7
Construction	5.6	5.8
Finance, insurance, and real estate	6.6	5.0
Transportation and public utilities	4.2	4.3
Farm employment	2.9	2.2
Mining	0.2[a]	0.2
Other Sectors	1.5	1.7

[a] Percentage only includes Clark and Fayette Counties. Data for Madison County not available.
Source: BEA 1999.

The ROI experienced stable growth throughout the 1990s. The labor force grew from 174,303 in 1990 to 200,848 in 2000, an average annual growth rate of 1.5 percent. Employment growth outpaced labor force growth, increasing from 166,834 in 1990 to 196,619 in 2000, an average annual growth rate of 1.8 percent. The ROI unemployment rate was 4.3 percent in 1990, falling to 2.1 percent in 2000, as shown in Table 4.3-2. The average unemployment rate for the State of Kentucky was 4.1 percent in 2000 (BLS 2000, KDES 2000).

Table 4.3-2. Region of Influence Unemployment Rates (Percent)

	1990	2000
Clark County	6.8	3.0
Fayette County	3.6	1.8
Madison County	6.0	2.7
ROI Total	4.3	2.1
Kentucky	5.9	4.1

Source: BLS 2000, KDES 2000.

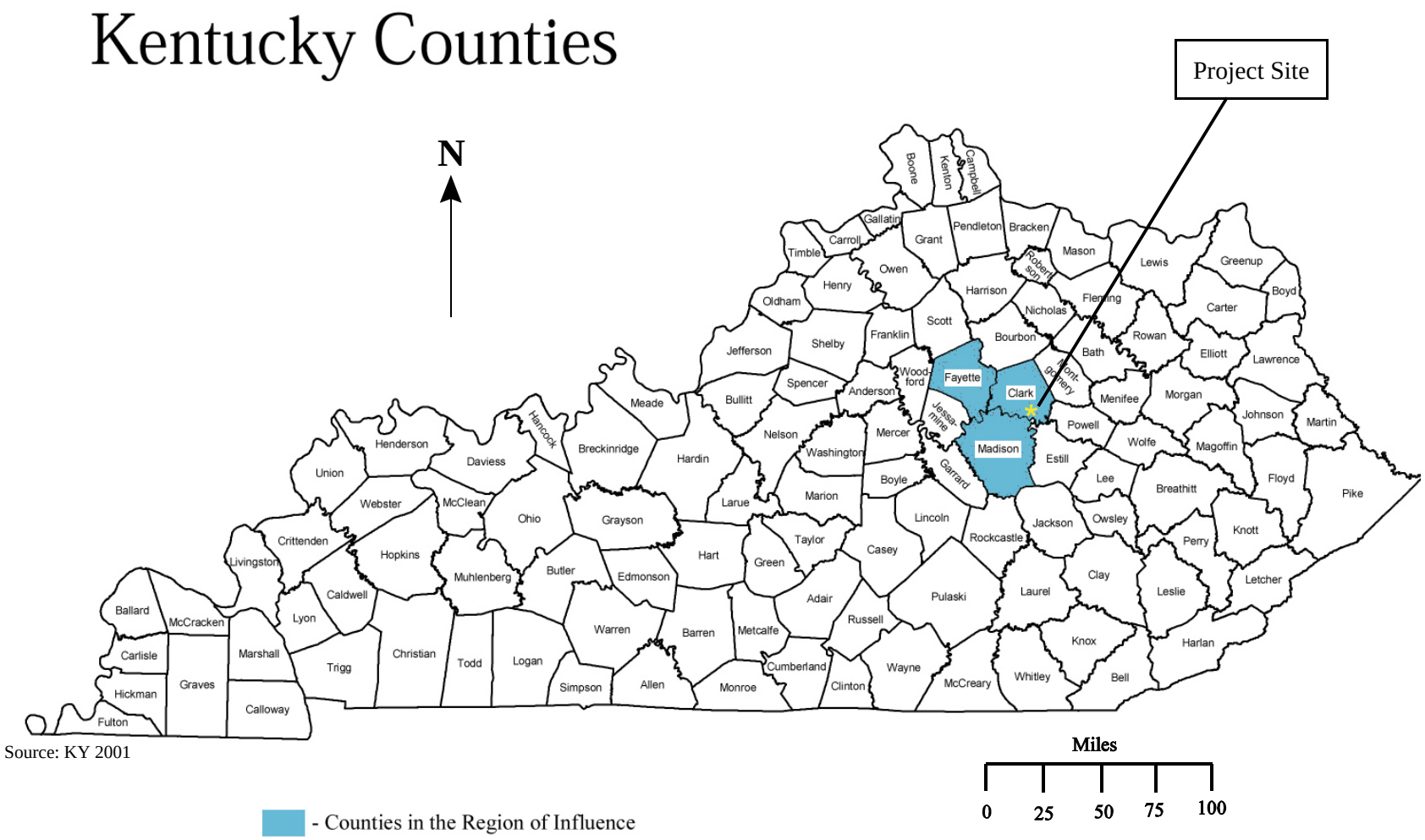


Figure 4.3-1. Location of Socioeconomic Region of Influence for Kentucky Pioneer IGCC Demonstration Project

Per capita income in the ROI was $25,515 in 1997, more than a 37 percent increase from the 1990 level of $18,351. Per capita income ranged from $18,249 in Madison County to $28,045 in Fayette County. The per capita income in Kentucky averaged $20,570 in 1997 while the U.S. average was $25,288 (BEA 1999).

4.3.2 Population and Housing

Over the last 20 years, population has grown at a much higher rate in the ROI compared to the State of Kentucky. ROI population increased 9.3 percent between 1980 and 1990 and an additional 16.7 percent between 1990 and 2000. The population of Kentucky increased less than 1 percent between 1980 and 1990 and 9.6 percent between 1990 and 2000. ROI population is projected to continue growing, increasing 4.4 percent between 2000 and 2010 compared to the state rate of 4.8 percent. Table 4.3-3 presents historic and projected population in the ROI and the state.

Table 4.3-3. Historic and Projected Population

	1980	1990	2000	2010
Clark County	28,322	29,496	33,144	34,602
Fayette County	204,165	225,366	260,512	271,975
Madison County	53,352	57,508	70,872	73,990
ROI	285,839	312,370	364,528	380,567
Kentucky	3,660,777	3,686,892	4,041,769	4,235,774

Source: Census 1995, Census 2000a, Census 2000c, Louisville 2000.
Year 2010 projections based on established rates applied to 2000 census counts.

Lexington, in Fayette County, is the largest city in the ROI with a 2000 population of 260,512. Other cities include Richmond and Berea in Madison County, with 2000 populations of 27,152 and 9,851, respectively, and Winchester in Clark County with a 2000 population of 16,724 (Census 2000c).

Table 4.3-4 presents housing characteristics in the ROI. There were a total of 130,833 housing units in the ROI in 1990. More than 60 percent of these houses were single-family units, approximately 35 percent were multifamily units, and 5 percent were mobile homes. Approximately 8 percent of the housing units were vacant. Approximately 56 percent of the occupied units were owner-occupied while 44 percent were rental units.

Table 4.3-4. Region of Influence Housing Characteristics

	Total Number of Housing Units	Number of Owner-Occupied Units	Owner-Occupied Vacancy Rates (Percent)	Median Value	Number of Occupied Rental Units	Rental Vacancy Rates (Percent)	Median Monthly Contract Rent
Clark County	11,635	7,492	1.0	$56,900	3,481	7.5	$264
Fayette County	97,742	47,460	2.6	$73,900	42,069	9.8	$338
Madison County	21,456	12,422	1.3	$55,500	7,590	8.8	$249
ROI	130,833	67,374	2.2	NA	53,140	9.5	NA

Source: Census 1992.

In 1990, the median value of owner-occupied housing in the ROI ranged from $55,500 in Madison County to $73,900 in Fayette County. The median monthly rent ranged from $249 in Madison County to $338 in Fayette County.

4.3.3 Community Services

This assessment presents the availability of public schools, law enforcement and fire and medical services in the project's ROI.

The four school districts serving the ROI are Clark, Fayette, and Madison Counties and Berea Independent. These districts utilize approximately 2,075 teachers to educate 48,500 students. There are also more than 20 private schools in the ROI educating an additional 4,050 students (KDE 2000). There are a number of institutions of higher learning in the ROI, including the University of Kentucky and Eastern Kentucky University.

The Clark, Fayette, and Madison Counties' Sheriff's departments as well as the Berea, Lexington, Richmond, and Winchester Police Departments provide law enforcement services for the ROI. The Clark County Sheriff's Office, comprised of 10 officers and the Sheriff, is responsible for law enforcement in the vicinity of the project site. The office is located in Winchester, approximately 19 kilometers (12 miles) from the proposed construction site.

There are four professional and five volunteer fire departments located in the ROI. Clark and Fayette Counties each have one professional department and Madison County has two professional departments. There are 27 professional and 5 volunteer fire stations and more than 40 fire trucks throughout the ROI. The majority of the stations and trucks, as well as all of the aerial units and seven of the eight emergency response units are located in Fayette County, where the majority of the population is concentrated. Over 130 fire personnel are available per shift in Fayette County while Madison County employs a total of 43 fire personnel. Madison County utilizes approximately 100 volunteers through 4 professional and 4 volunteer stations.

The Clark County Fire Services would be directly responsible for an emergency at the proposed site. Clark County houses 2 fire stations that utilize 6 trucks and 21 professional and 20 volunteer fire personnel and 2 separate trucks manned by 2 volunteers each. Both stations are located in the town of Winchester and are between 12 and 13 miles from the proposed site. Average response time to an emergency situation or fire from these two stations to Trapp would be approximately 10 to 15 minutes. One of the volunteer trucks is located in Trapp and a new county station is set to begin construction near the J.K. Smith Site outside of Trapp in the near future, which will help to reduce the response time to any potential emergency during the proposed construction.

The 8 emergency response units also service the 13 hospitals located in the ROI. There are approximately 110 physicians servicing the almost 2,900 combined beds in these hospitals (AHA 1995). The majority of the hospitals are located in the city of Lexington in Fayette County.

4.4 Cultural Resources

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. Cultural resources include expressions of human culture and history in the physical environment such as prehistoric or historic archaeological sites, buildings, structures, objects, districts, or other places including natural features and biota which are considered to be important to a culture, subculture, or community. Cultural resources also include traditional lifeways and practices, and community values and institutions.

The cultural resources present in Kentucky demonstrate the prehistoric use of the region for over 10,000 years; the early Euroamerican settlement, pre-Civil War regionalism, Civil War history, postbellum industrialization, and developments between the World Wars and the Modern era. Kentucky is one of the most active states with regard to the identification of cultural resources and the promotion of responsible stewardship of the cultural heritage of the commonwealth.

4.4.1 Cultural Resource Types

Cultural resources have been organized into the categories of prehistoric resources, historic resources, and traditional cultural properties (TCPs) and practices. These types are not exclusive and a single cultural resource may have multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by people before the establishment of a Euroamerican presence in the region. Historic cultural resources include architectural resources and other material remains and landscape alterations that have occurred since the arrival of Euroamericans in the region. TCPs and practices refer to places or activities associated with the cultural heritage or beliefs of a living community, which are important in maintaining cultural identity.

4.4.2 Cultural Resource Regulations

The identification of cultural resources and DOE responsibilities with regard to cultural resources are addressed by a number of laws, regulations, executive orders, programmatic agreements and other requirements. The principal federal law addressing cultural resources is the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 United States Code [USC] 470), and implementing regulations (36 *Code of Federal Regulations* [CFR] 800) that describe the process for identification and evaluation of historic properties; assessment of the effects of federal actions on historic properties; and consultation to avoid, reduce, or minimize adverse effects. The term "historic properties" refers to cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP). This process does not require preservation of historic properties, but does ensure that the decisions of federal agencies concerning the treatment of these places result from meaningful considerations of cultural and historic values and of the options available to protect the properties.

Under the NHPA, cultural resources undergo an evaluation process to determine whether a resource is eligible for listing on the NRHP. Resources that are already listed, determined eligible for listing, or are undetermined are afforded a level of consideration under the NHPA Section 106 review process. Undetermined resources are those for which eligibility cannot be determined based on current knowledge of the resource and where further work is needed to make an evaluation.

In order to be determined eligible for listing on the NRHP, a resource must meet one or more of the following criteria (36 CFR 60):

Criterion A – associated with events that have made a significant contribution to the broad patterns of our history.
Criterion B – associated with the lives of persons significant in our past.
Criterion C – embodied the distinctive characteristics of a type, period, or method of construction.

Criterion D – yielded or may be likely to yield information important in prehistory or history.

The resource must also retain most, if not all, of the seven aspects of integrity: location, design, setting, workmanship, material, feeling, and association.

The identification and evaluation of cultural resources for NRHP-eligibility is the responsibility of the lead federal agency with the concurrence of the State Historic Preservation Officer (SHPO), in this case the Kentucky Heritage Council. The Advisory Council on Historic Preservation, an independent federal agency, administers the provisions of Section 106 of the NHPA regarding cultural resources and has review and oversight responsibilities defined in 36 CFR 800. It should be noted that the provisions of the NHPA refer only to cultural resources that are tangible properties and that federal agencies are required by other statutes to consider impacts on traditional cultural and religious practices.

4.4.3 Cultural Resources of the Proposed Facility Location

Extensive cultural resource identification work was conducted in support of the J.K. Smith EA in 1980 (Turnbow and Jobe 1981). The initial work consisted of a literature review and a pedestrian survey for archaeological and architectural resources of the entire 1,263-hectare (3,120-acre) EKPC property, which includes the 121-hectare (300-acre) proposed Kentucky Pioneer IGCC Demonstration Project facility location. As a result of these investigations, 231 archaeological sites and 33 standing structures were documented and recommendations were made regarding further work. Seventy-three archaeological sites were identified in proposed construction areas, and fieldwork was conducted at 44 of these to determine NRHP eligibility. All 13 standing structures in the construction areas for the earlier project were evaluated at that time as not meeting the criteria for NRHP eligibility. After further evaluation fieldwork, it was determined that three archaeological sites met the criteria for NRHP eligibility and adverse effects were subsequently mitigated through data recovery excavations under the terms of an agreement with the SHPO (Turnbow and Jobe 1981). There were no additional studies or consultations conducted to identify cultural landscapes, ethnographic or TCP resources. The Section 106 review process was completed in concurrence with the SHPO prior to the initiation of grading and other site preparation activities for the J.K. Smith facility. Resources identified outside of the construction areas, including the NRHP-listed Brock House, were not impacted at that time. Results of the cultural resource work performed on the site are summarized in *Cultural Resource Investigations of the J.K. Smith Power Station* and recovered artifacts have been curated at the William S. Webb Museum at the University of Kentucky in Lexington (Turnbow and Jobe 1981).

Consultation with the Kentucky Heritage Council has determined an appropriate identification effort for the proposed Kentucky Pioneer IGCC Demonstration Project. The Kentucky SHPO has confirmed that the Section 106 review process was completed for the Kentucky Pioneer IGCC Demonstration Project's Area of Potential Effect in December of 1980. The terms of the Memorandum of Agreement drawn up in conjunction with the Advisory Council on Historic Preservation for the J.K. Smith Power Station have been met under the Kentucky Pioneer IGCC Demonstration Project and further identification, evaluation, mitigation, and consultation activities are no longer required. The Area of Potential Effect includes the 121-hectare (300-acre) J.K. Smith project site and any additional potential disturbance areas such as borrow pits, construction laydown areas, or utility, transportation and transmission line corridors. The Area of Potential Effect also includes consideration of the potential for visible, audible, and atmospheric alterations to the setting of off-site cultural resources. The proposed project site is entirely within the construction area which was examined for cultural resources and subsequently graded for construction of the J.K. Smith facility. The potential for the existence and discovery of intact prehistoric or historic archaeological resources that would meet NRHP eligibility requirements is considered very low. Likewise, no Native American or other traditional use areas or religious sites are known to be present or are expected in the proposed project area. The precise location of any additional disturbance areas such as transmission line corridors has not yet been defined. As these areas are defined, an appropriate cultural resource identification effort and assessment of effects will be conducted.

4.5 Aesthetic and Scenic Resources

This section describes the visual character of the Kentucky Pioneer IGCC Demonstration Project and briefly discusses the scenic areas in the vicinity of project site.

The project site is located on the edge of the Outer Bluegrass and Knobs Physiographic Regions. The Knobs Region is characterized by subconical hills while the Bluegrass Region is a central lowland. The project site subconical and surrounding area is managed and owned by EKPC. The project site is located 1.6 kilometers (1 mile) west of the community of Trapp, Kentucky. As discussed in Section 4.2, Land Use, additional areas within the 1,263-hectare (3,120-acre) J.K. Smith Site are being utilized by EKPC. Near the project site, EKPC owns and operates three gas turbines on approximately 19 hectares (48 acres) of land. The turbines are located on the J.K. Smith Site approximately 0.8 kilometers (0.5 miles) west of the proposed 121-hectare (300-acre) project site.

4.5.1 Visual Character of the Kentucky Pioneer IGCC Demonstration Project Facility Site

The 121-hectare (300-acre) project site is located within the 1,263-hectare (3,120-acre) J.K. Smith Site that is accessed through a gated perimeter fence and access road. The project site has been previously disturbed. Preliminary grading, primary foundations, fire protection piping, and rail access infrastructure already exist on the site. Although many project facilities are visible from Kentucky Highway 89, all facilities are located approximately 0.8 kilometers (0.5 miles) from the highway.

4.5.2 Scenic Areas

There are 19 designated scenic byways located throughout the State of Kentucky. However, none of these scenic byways are located within Clark or Madison County.

There are nine sections of river designated as Kentucky Wild Rivers, which cover approximately 182 kilometers (114 miles). These rivers are characterized by undisturbed shorelines and vistas. The Red River, which runs through the Daniel Boone National Forest, is the closest Kentucky Wild River to the project site. The Daniel Boone National Forest is 24 kilometers (15 miles) east of the project site. A 14.4-kilometer (9-mile) stretch of the Red River, located within the Daniel Boone National Forest, is also designated as a National Wild and Scenic River. The Red River joins the Kentucky River approximately 2.4 kilometers (1.5 miles) south-southeast of the project site.

The proposed route for the 138-kV line extends northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky, where it will interconnect with the existing local power grid. The proposed new transmission line would be approximately 27 kilometers (17 miles) in length; however, the exact route for the line has yet to be determined. Based on the general area within Clark and Montgomery Counties, the proposed route is not expected to cross any scenic areas.

4.6 Geology

This section describes the geologic, physiographic, and seismic characteristics of the Kentucky Pioneer IGCC Demonstration Project site and surrounding area. This discussion also applies to the areas affected by the transmission line.

4.6.1 General Geology and Physiography

The project site is located at the edges of the Outer Bluegrass section of the Bluegrass Physiographic Region and the Knobs Physiographic Region (see Figure 4.6-1). The Outer Bluegrass is present in the western portion of the site. It is mostly composed of interbedded limestone and shales and is characterized by deep valleys with little flat land. The Knobs Region, in the eastern portion of the site, consists of shale, which is characterized by subconical knobs eroded by streams along the inner edge of the plateau uplands. From a geological perspective, no transition zone between the two regions is defined. Elevation at the project site varies from approximately 213 to 245 meters (700 to 805 feet) above main sea level.

The project site is located on the eastern flank of the Cincinnati Arch, characterized by gently up-folding rocks extending from the Nashville, Tennessee, area northward into Canada (see Figure 4.6-2). The site and surrounding area are underlain by rocks of Ordovician, Silurian, Devonian, and Mississippian Periods. The rocks are all sedimentary, dip very gently, and consist of shales, limestones, dolomites, silty dolomites, and calcareous shales.

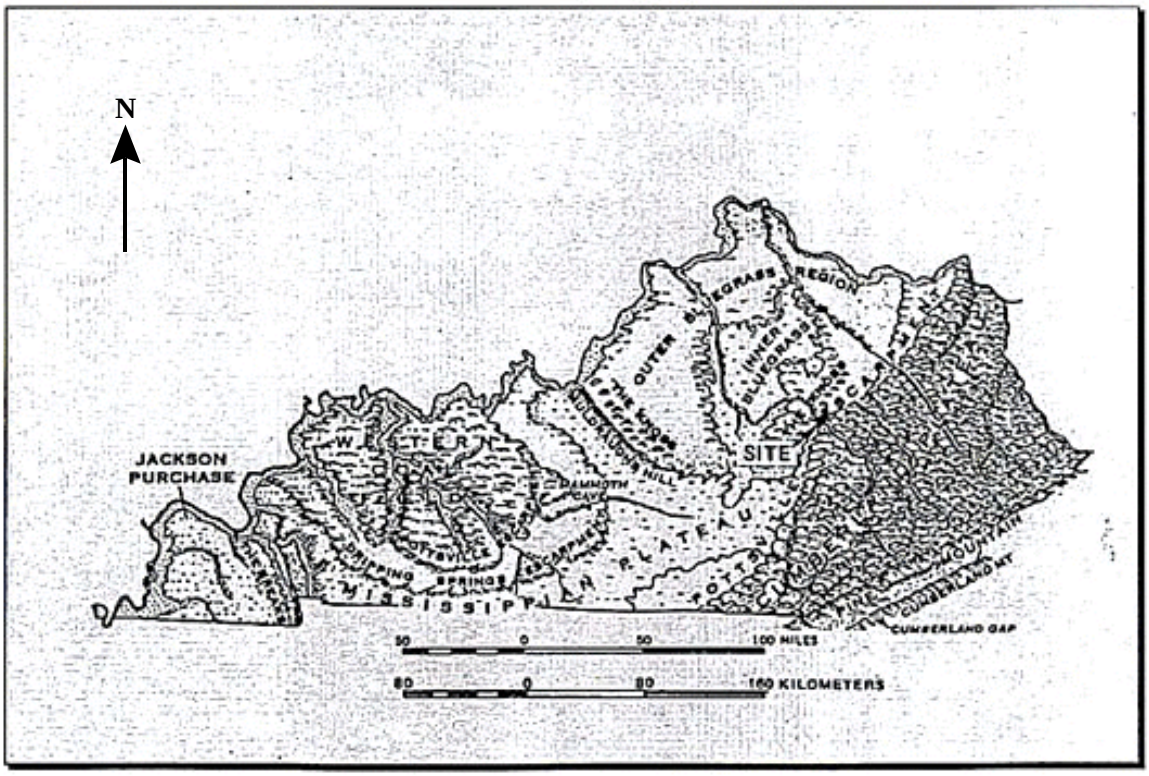
Exposed formations of the Ordovician (490 to 435 million years ago) include the limestone, shales, and dolomites of the Ashlock and Drakes dolomitic shale. In the project site vicinity, the Upper Ordovician Ashlock Formation outcrops are located along the Kentucky River and Bull Run, Upper Howard Creek and Cotton Creek tributaries. Outcrops of the Ashlock Formation are located throughout the area. Silurian formations (435 to 400 million years ago) are in the project area and consist of the Brassfield Dolomite and Crab Orchard formation.

The Devonian Period (400 to 355 million years ago) is represented by the Boyle Dolomite and the New Albany Shale. The Boyle Dolomite is thin to absent in the project area and is underlain by the Crab Orchard Formation. The Boyle Dolomite contains some petroliferous residue. A stratigraphic column showing the formations found in the project area is shown in Figure 4.6-3.

As part of the early site characterization efforts, two borings (depths up to 18 meters [60 feet]) were completed at the project site. Both borings encountered interbedded shale and dolomites of the New Albany, Boyle, Crab Orchard, Brassfield, and Drakes Formation. Bedrock was encountered at approximately 1.5 meters (5 feet) below ground surface.

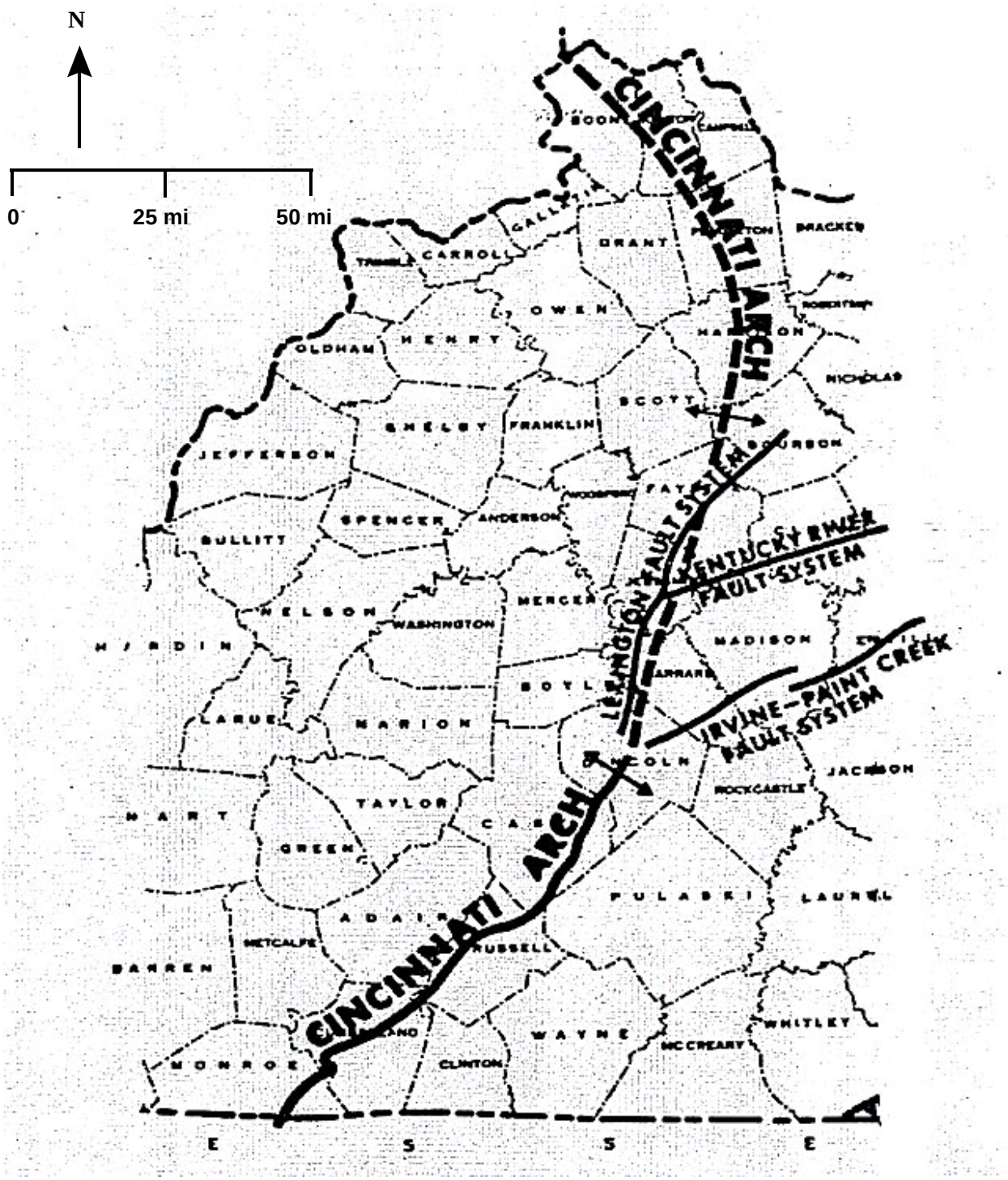
Karst Terrain. On the whole, Kentucky is known to contain large areas of karst. Karst occurs primarily in limestone or where other soluble bedrock is near the earth's surface and fractures in the rock become enlarged when the rock dissolves. This action is behind the development of caves and can lead to depressions of the ground surface or ground failures known as sinkholes.

Karst areas considered to be "highly developed" in the state are located northeast of Clark County in the Inner Blue Grass physiographic region and also in the western portion of the state. These areas tend to have limestone bedrock. Although the surficial bedrock unit at the project site is the New Albany Shale, the project site is located in a broad area categorized as "less developed" karst terrain that extends over much of north-central Kentucky.



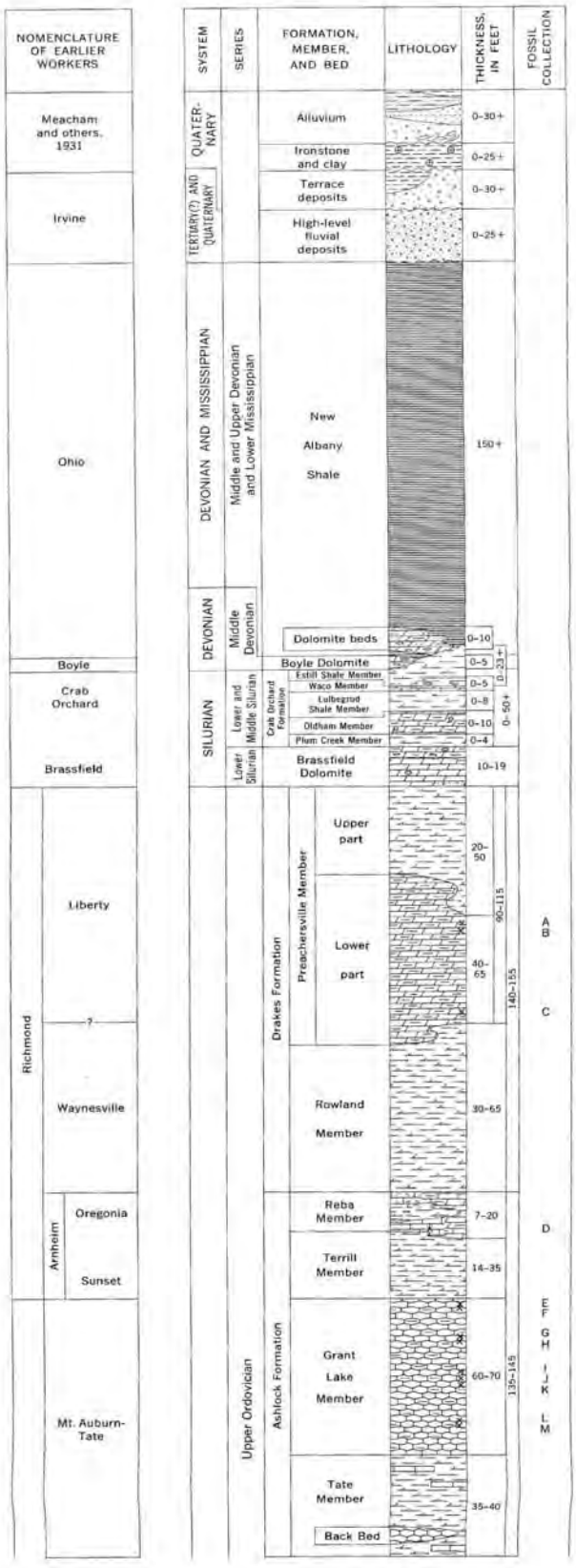
Source: EIV 2000.

Figure 4.6-1. Kentucky Physiographic Regions



Source: EIV 2000.

Figure 4.6-2. Tectonic Features of Central Kentucky



Source: KGS 1975.

Figure 4.6-3. Stratigraphic Column

A map of karst areas in *Ground Water Resources of Clark County, Kentucky* (KGS 2001) divides the county into three karst zones: non-karst, karst prone, and intense karst. The western half of the county is mostly intense karst and includes large areas of limestone bedrock. The southeastern part of the county, including the area east of Trapp, is non-karst; much of this area coincides with areas of New Albany Shale bedrock. On this map, the project site lies approximately at the boundary of the large non-karst area in and around Trapp with a karst prone area. However, this map was prepared using a source map of 1:500,000 scale and thus is not intended for site-specific, detailed use. Given that the project site is located in an area of New Albany Shale bedrock, it may be within the non-karst area depicted on this map.

The site-specific borings installed as part of the initial site characterization effort show that the surficial geology of the project site is the New Albany Shale (extends 3.6 to 4.6 meters [12 to 15 feet] below grade), which is underlain by a thin (0.3 to 0.6 meter [1 to 2 feet]) layer of the Boyle Dolomite. This unit was reported in the two boring logs to be "vuggy" (vugs are small cavities in the solid rock). Beneath the Boyle Dolomite is the Crab Orchard Formation, which is predominately shale with interbedded dolomites that were reported in one of the two boring logs to be vuggy. Although vugs can be conduits for groundwater flow, there is no mention of water in these formations on the boring logs (EIV 2000). In addition, none of the geologic formations found beneath the project site are described as having karst features such as sinkholes, or having underground drainage features, such as solutional enlargement of fractures and bedding-plane openings (KGS 2001).

Structural Geology. The major structural feature in the area is the Kentucky River fault system. This fault system is present in central Clark County and consists of a narrow bank of normal faults and grabens. Four faults are present in the general project vicinity: the Howard Creek fault is located approximately 1.2 kilometers (0.7 miles) southwest of the project site, the Cotton Creek fault is 1.6 kilometers (1 mile) farther to the southwest; and the Eagle Nest and Ruckerville faults are located 3.2 to 4.8 kilometers (2 t o 3 miles) north of the project site, respectively. None of these faults have moved in historic time (KGS 1975). Other faults are associated with the Irvine-Paint Creek fault system, located approximately 50 kilometers (31 miles) south of the project site.

Seismology. The major part of east-central Kentucky, including the project site, is in Seismic Zone 1, a region of limited earthquake activity. The most significant event within 50 kilometers (31 miles) of the site occurred on February 28, 1854, with an epicentral intensity of IV on the Modified Mercalli (MM) index (see Table 4.6-1). The earthquake occurred near Lexington, Kentucky. Lexington experienced another earthquake on February 20, 1869, with an intensity of IV MM; however, the earthquake was not felt in the surrounding areas. The only other earthquakes to have occurred within 50 kilometers (31 miles) of the site occurred on June 6, 1989, and June 26, 1989, near Richmond, Kentucky. Figure 4.6-4 illustrates the epicentral locations of all earthquakes that are known to have had an epicentral intensity of IV or greater in the area defined by the latitudes of 36° North and 40° North and longitudes of 82° West and 86° West (EIV 2000).

The far southwest corner of the area depicted in Figure 4.6-4 is the northeastern-most part of the New Madrid Seismic Zone, a very seismically active area. Historically, this area has been the site of some of the largest earthquakes in North America. One of these was the February 7, 1812, intensity XI-XII MM event that occurred in New Madrid, Missouri. The effects in Lexington (34 kilometers [21 miles] northwest of the project site) were described as severe, but not as having caused any material damage (intensity of VI MM). The return period for such an event has been estimated at between 510 to 1,000 years (EIV 2000). Similarly, an event of intensity IX MM occurred in the vicinity of Charleston, Missouri, on October 13, 1895. Newspapers local to the proposed project site described effects in the area as what is generally accepted to be those of intensity IV MM or less (EIV 2000).

Mineral Resources. According to the Mineral and Fuel Resources Map of Kentucky, there are no geologic resources in the project area (KGS 1998).

Table 4.6-1. The Modified Mercalli Intensity Scale of 1931, With Approximate Correlations to Richter Scale and Maximum Ground Acceleration[a]

Modified Mercalli Intensity[b]	Observed Effects of Earthquake	Approximate Richter Magnitude[c]	Maximum Ground Acceleration[d]
I	Usually not felt	<2	negligible
II	Felt by persons at rest, on upper floors or favorably placed	2-3	<0.003 g
III	Felt indoors; hanging objects swing; vibration like passing of light truck occurs; might not be recognized as earthquake	3	0.003 to 0.007 g
IV	Felt noticeably by persons indoors, especially in upper floors; vibration occurs like passing of heavy truck; jolting sensation; standing automobiles rock; windows, dishes, and doors rattle; wooden walls and frames may creak	4	0.007 to 0.015 g
V	Felt by nearly everyone; sleepers awaken; liquids disturbed and may spill; some dishes break; small unstable objects are displaced or upset; doors swing; shutters and pictures move; pendulum clocks stop or start	4	0.015 to 0.03 g
VI	Felt by all; many are frightened; persons walk unsteadily; windows and dishes break; objects fall off shelves and pictures fall off walls; furniture moves or overturns; weak masonry cracks; small bells ring; trees and bushes shake	5	0.03 to 0.09 g
VII	Difficult to stand; noticed by car drivers; furniture breaks; damage moderate in well built ordinary structures; poor quality masonry cracks and breaks; chimneys break at roof line; loose bricks, stones, and tiles fall; waves appear on ponds and water is turbid with mud; small earthslides; large bells ring	6	0.07 to 0.22 g
VIII	Automobile steering affected; some walls fall; twisting and falling of chimneys, stacks, and towers; frame houses shift if on unsecured foundations; damage slight in specially designed structures, considerable in ordinary substantial buildings; changes in flow of wells or springs; cracks appear in wet ground and steep slopes	6	0.15 to 0.3 g
IX	General panic; masonry heavily damaged or destroyed; foundations damaged; serious damage to frame structures, dams and reservoirs; underground pipes break; conspicuous ground cracks	7	0.3 to 0.7g
X	Most masonry and frame structures destroyed; some well built wooden structures and bridges destroyed; serious damage to dams and dikes; large landslides; rails bent	8	0.45 to 1.5 g
XI	Rails bent greatly; underground pipelines completely out of service	9	0.5 to 3 g
XII	Damage nearly total; large rock masses displaced; objects thrown into air; lines of sight distorted	9	0.5 to 7 g

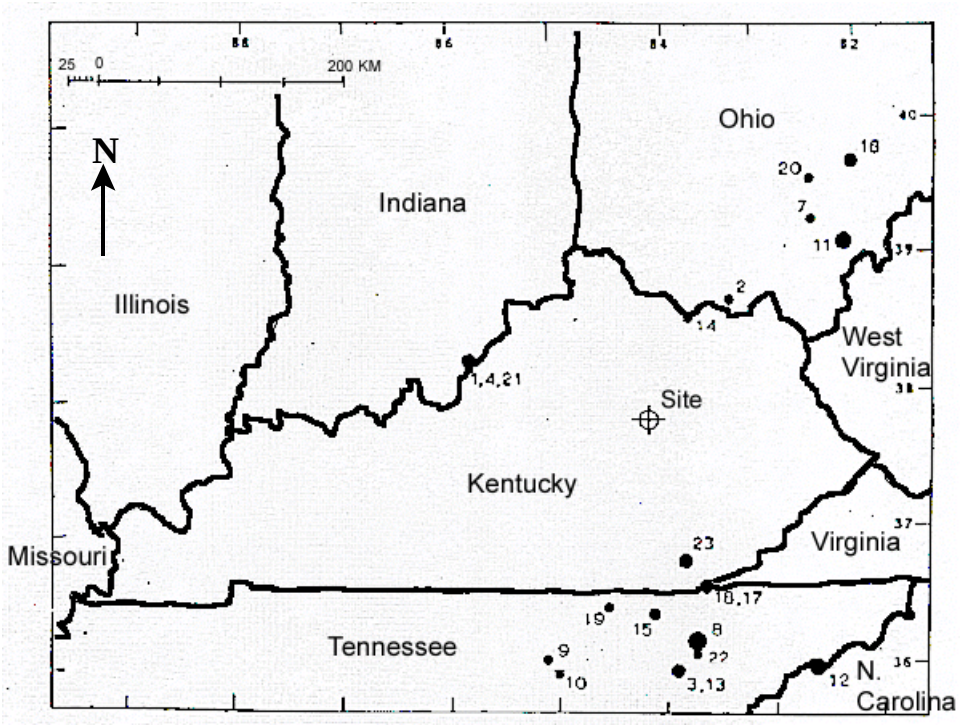
Source: ICSSC 1995, PPI 1994.

[a] This table illustrates the approximate correlation between the MM scale, the Richter scale, and maximum ground acceleration.

[b] Intensity is a unitless expression of observed effects.

[c] Magnitude is an exponential function of seismic wave amplitude, related to the energy released.

[d] Acceleration is expressed in relation to the earth's gravitational acceleration (0).



Event No.	Date month-day-year	Epicentral Coordinates ºN/ºW	Felt Area in sq. km (sq. mi)	Intensity (MM)
1	08 07 1827	38.3/85.8		VI
2	03 10 1827	38.7/83.8	550,00 (340,000)	V
3	11 28 1844	36.0/83.9		VI
4	04 05 1850	38.3/85.8		V
5	02 28 1854	37.6/84.5	20,000 (12,500)	IV
6	02 20 1869	38.1/84.5		IV
7	05 17 1901	39.3/82.5	25,000 (15,000)	V
8	03 28 1913	36.2/83.7	7,000 (4,350)	VII
9	06 22 1918	36.1/84.1	8,000 (5,000)	V
10	12 24 1920	36.0/85.0		V
11	11 05 1926	39.1/82.1	900 (560)	VI-VII
12	11 02 1928	36.0/82.6	40,000 (25,000)	VI-VII
13	10 16 1930	36.0/83.9		V
14	05 28 1933	38.6/83.7	1,800 (1,100)	V
15	02 10 1948	36.4/84.1		V-VI
16	06 20 1952	39.7/82.1	13,000 (8,100)	VI
17	01 02 1954	36.6/83.7		VI
18	01 25 1957	36.6/83.7		VI
19	06 23 1957	36.5/84.5		V
20	04 08 1967	39.6/82.5	10,000 (6,200)	V
21	12 11 1968	38.3/85.5		V
22	07 13 1969	36.1/83.7	50,00 (31,000)	V
23	01 19 1976	36.9/83.8		VI

Source: Modified from EIV 2000.

Figure 4.6-4. Regional Seismic Events

4.6.2 Soils

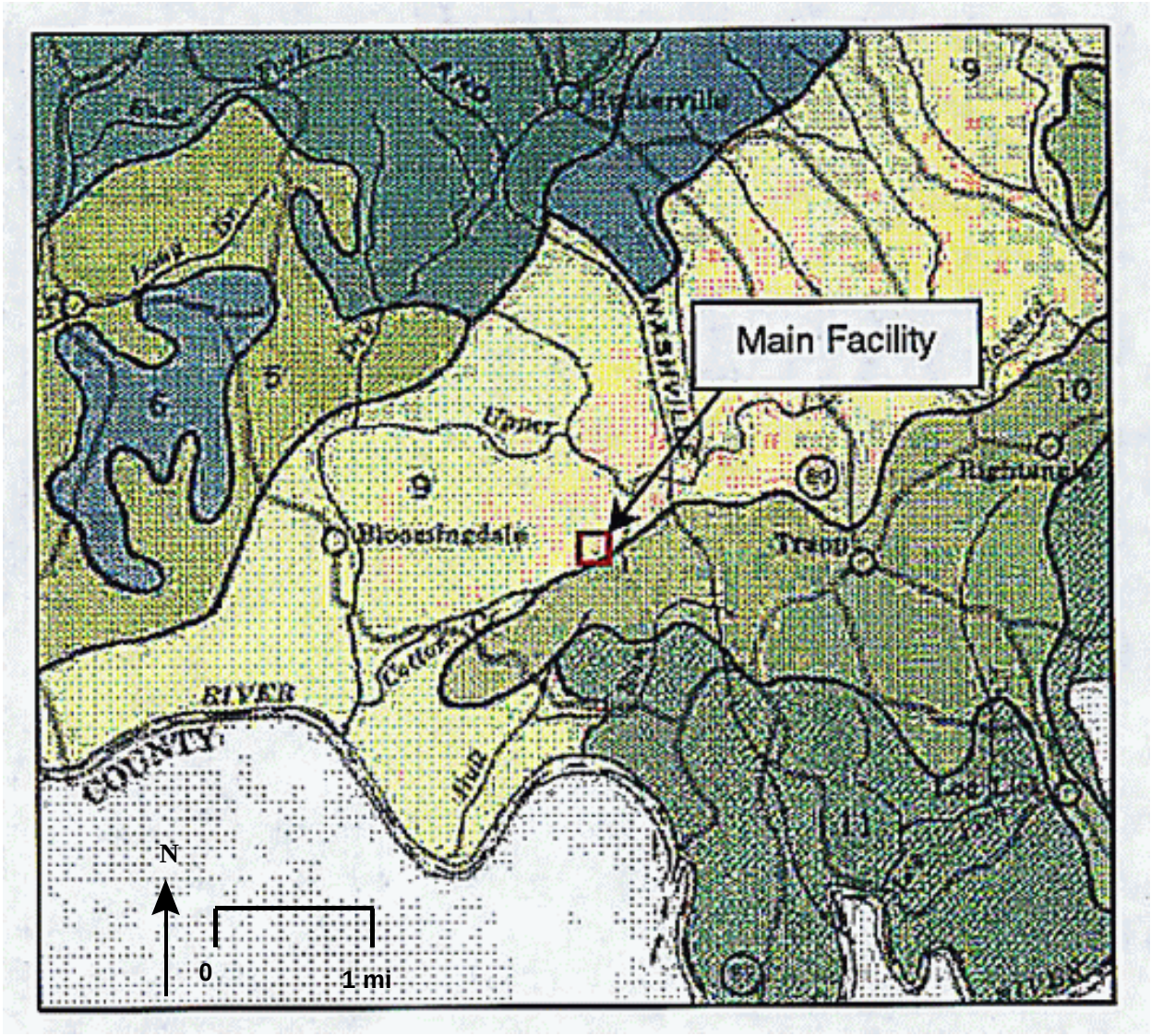
The site contains three soil associations: the Otway-Beasley, the Coyler-Trappist-Muse, and the Otway-Fleming-Shrouts (Figure 4.6-5). Within these three associations, seven different soil series and areas classified as rock outcrop occur on the project site. The dominant soil series found on the site are the Tilsit, Colyer, and Otway; these series are described below.

Tilsit Series. The Tilsit series consists of moderately deep, moderately well-drained soils of upland formed in residuum from acid shale. Most of the areas are on broad, nearly flat ridgetops. The surface layer is generally dark grayish-brown, friable silt loam and the subsoil is slightly firm silty clay loam. These soils are extremely acidic, are medium in natural fertility, and have a moderately low erosion hazard.

Colyer Series. The Colyer series consists of shallow to very shallow, excessively-drained soils of uplands. These soils are underlain by black, acid shale and are found on ridgetops and steep side slopes in rough, broken areas. These soils have a thin surface layer of brown silty clay loam, are extremely acidic, and low in natural fertility. The Colyer soils found at the project site are considered to have a moderately-high to high erosion hazard.

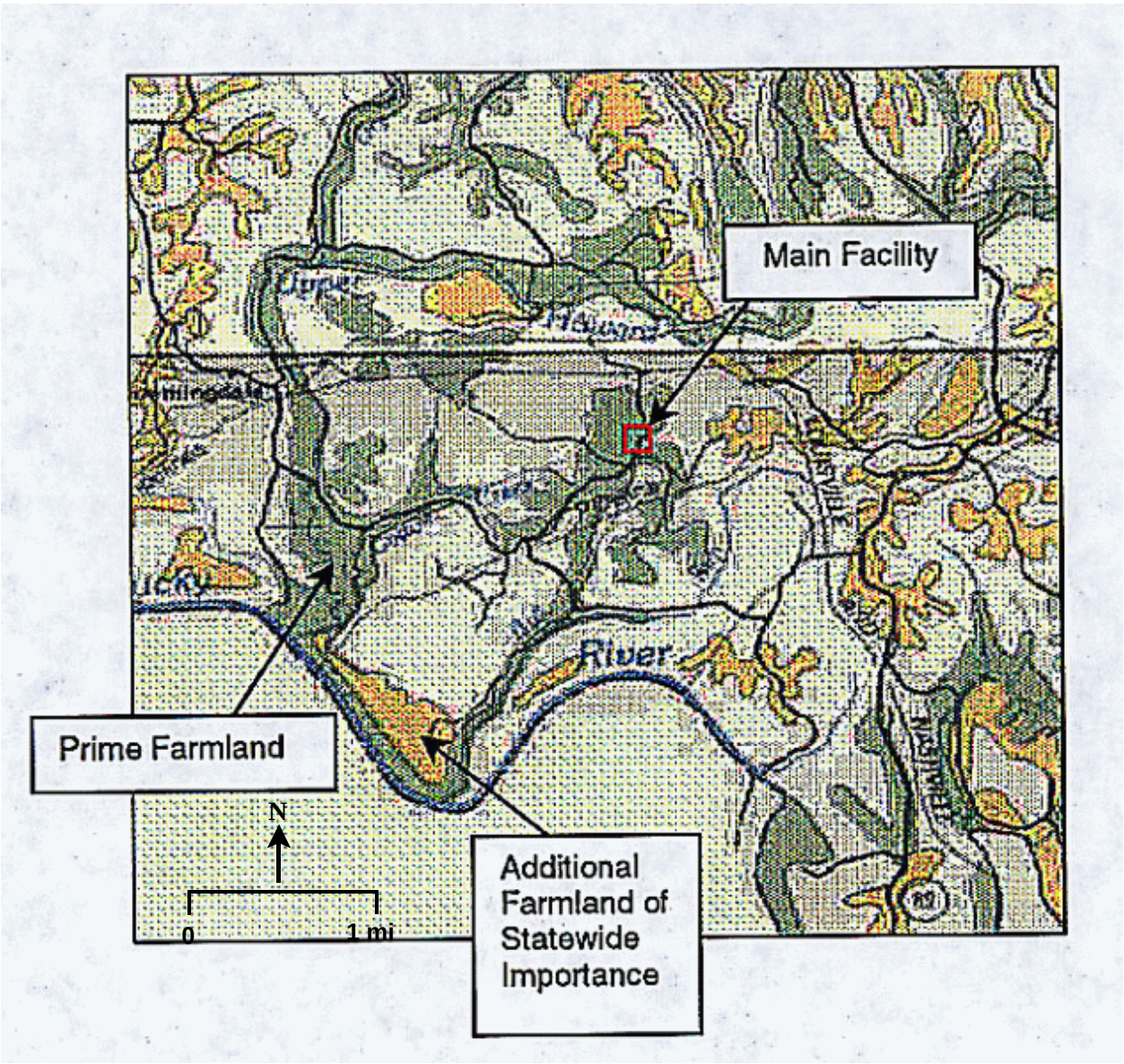
Otway Series. The Otway series consists of shallow to very shallow, somewhat excessively-drained soils of the uplands. These soils are found in rough, broken areas and were formed in residuum from soft, calcareous shale, commonly called marl. The surface layer is a very dark grayish-brown, firm silty clay loam. At the project site, these soils are found on steep side slopes near intermittent streams. In most areas mapped, erosion has removed the surface layer leaving a very firm, silty clay exposed. These soils are highly susceptible to further erosion.

Prime Farmland. Prime farmland is the most productive agricultural land that has the best combination of physical and chemical properties for producing food, feed, forage, fiber, and oil seed crops. A prime farmland area has the moisture and growing season necessary to produce economically sustainable high yield crops when treated and managed according to acceptable methods (UEC 1980). Approximately 100 percent of the site and surrounding area was covered by soils classified as prime farmland prior to site preparation in the late 1970s (see Figure 4.6-6). These soils consisted of Egam silt loam; Tilsit silt loam; Trappist silt loam; Captina silt loam; Allegheny loam; Ashton silt loam; Bedford silt loam; Huntington silt loam; Lindside silt loam; Beasley silt loam; and Neward silt loam (UEC 1980). However, the Clark County Conservation District has determined that southern Clark County does not generally have good cropland and only has a fair potential as pastureland (UEC 1980).



Source: EIV 2000.

Figure 4.6-5. General Soil Map of the Project Site Area



Source: EIV 2000.

Figure 4.6-6. Prime Farmland

4.7 Air Resources

This section describes the air resources of the Kentucky Pioneer IGCC Demonstration Project and the surrounding area.

4.7.1 Climate and Meteorology

The Kentucky Pioneer IGCC Demonstration Project site is characterized by warm summers and moderately cold winters. Average daily low temperatures range from about negative 5.5 degrees Celsius (°C) (22 degrees Fahrenheit [°F]) in January to about 19°C (66°F) in July (EIV 2000). Average daily high temperatures range from about 9°C (39°F) in January to about 30°C (86°F) in July. The average length of the growing season is about 181 days. On average, periods with freezing temperatures occur between October 26 and April 23.

The normal annual precipitation is approximately 114 centimeters (45 inches), with a small portion occurring as snowfall. Precipitation is distributed fairly uniformly throughout the year. Fall and winter precipitation is usually associated with the passage of warm or cold fronts. Summer precipitation often occurs as brief heavy showers or thunderstorms.

Regional prevailing winds are from the south and south-southwest during most of the year. The only relatively recent meteorological data collected on the EKPC property was obtained during a 6-month period in 1979. The monitoring instrument was located about 1.6 kilometers (1 mile) southwest of the proposed Kentucky Pioneer IGCC Demonstration Project site. The on-site meteorological data indicated that winds at that location were most often from either the south-southwest or northeast during the measurement period (UEC 1980). The meteorological tower was in a valley aligned with the measured predominant wind directions, indicating that local terrain conditions affected the site. Wind directions at the project site may be slightly different.

4.7.2 Ambient Air Quality

4.7.2.1 Terminology

This section presents definitions of technical terminology associated with air pollution. It is important to understand the distinction between air pollutant emissions and ambient air quality. Other important terms include primary pollutants, secondary pollutants, and pollutant precursors.

The term “pollutant emissions” refers to the amount (usually stated as a weight) of one or more specific compounds introduced into the atmosphere by a source or group of sources. In practice, most pollutant emissions data are presented as “emission rates”: the amount of pollutants emitted during a specified increment of time or during a specified increment of emission source activity. Typical measurement units for emission rates on a time basis include pounds per hour, pounds per day, or tons per year (TPY). Typical measurement units for emission rates on a source activity basis include pounds per thousand gallons of fuel burned, pounds per ton of material processed, and grams per vehicle mile of travel.

The term “ambient air quality” refers to the atmospheric concentration of a specific compound (amount of pollutants in a specified volume of air) actually experienced at a particular geographic location that may be some distance from the source of the relevant pollutant emissions. Ambient air quality data generally are reported as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction (e.g., parts per million by volume).

The ambient air quality levels actually measured at a particular location are determined by the interactions among three groups of factors: emissions, meteorology, and chemistry. Emission considerations

include the types, amounts, and locations of pollutants emitted into the atmosphere. Meteorological considerations include wind and precipitation patterns affecting the distribution, dilution, and removal of pollutant emissions. Chemical considerations are important when chemical reactions transform pollutant emissions into other chemical substances.

Air pollutants are often characterized as being "primary" or "secondary" pollutants. Primary pollutants are those emitted directly into the atmosphere, such as carbon monoxide, sulfur dioxide, lead, particulates, and hydrogen sulfide. Secondary pollutants are those formed through chemical reactions in the atmosphere, such as ozone, nitrogen dioxide, and sulfate particles. Atmospheric chemical reactions usually involve primary pollutants, normal constituents of the atmosphere, and other secondary pollutants. Meteorological conditions such as temperature, humidity, and the intensity of ultraviolet light can also play an important role in atmospheric chemistry.

Those compounds which react to form secondary pollutants are often referred to as reactive pollutants, pollutant precursors, or precursor emission products. Some air pollutants, such as many organic gases and suspended particulate matter, are a combination of primary and secondary pollutants.

Ozone, a major component of photochemical smog, is the secondary pollutant of greatest concern in most parts of the country. The pollutant emissions generally categorized as ozone precursors fall into two broad groups of chemicals: nitrogen oxides and organic compounds. Many different terms are used to refer to these groups of ozone precursors.

The terms "nitrogen oxides" and "oxides of nitrogen" are often used interchangeably to refer to the combination of nitric oxide and nitrogen dioxide. This combination of nitrogen oxides is often designated by the symbol NO_X. Nitrogen dioxide is itself a secondary pollutant, generally formed from nitric oxide.

Organic compound precursors of ozone are routinely described by a large number of different terms. The phrase "reactive organic compounds" is the most accurate terminology for describing organic compound precursors of ozone, but the acronym for that phrase is not widely used. The closest widely used acronym is reactive organic gases (ROG). To avoid inventing a new acronym, ROG will be used in this document to mean reactive organic compounds.

Inhalable particulate matter (PM_{10}) can be generated as a primary pollutant by abrasion or erosion processes. PM_{10} can also form as a secondary pollutant through chemical reactions or by condensation of gaseous pollutants into fine aerosols. Major gaseous precursors of PM_{10} include reactive organic gases, sulfur oxides (SO_X), and NO_X. Additional precursors of PM_{10} can include ammonia, hydrogen sulfide (H_2S), sulfuric acid, and nitric acid.

4.7.2.2 Air Quality Management

Air quality management programs have evolved using two management approaches. One approach is setting ambient air quality standards for acceptable exposure to air pollutants, conducting monitoring programs to identify locations experiencing air quality problems, and then developing programs and regulations designed to reduce or eliminate those problems. The second approach is identifying specific chemical substances that are potentially hazardous to human health, and then regulating the amount of those substances that can be released by individual commercial or industrial facilities or by specific types of equipment.

Air quality programs based on ambient air quality standards typically address air pollutants that are produced in large quantities by widespread types of emission sources and which are of public health concern because of their toxic properties. Air quality programs based on regulation of other hazardous substances typically address chemicals used or produced by limited categories of industrial facilities. Programs regulating hazardous air pollutants focus on substances that alter or damage the genes and chromosomes in

cells, creating the potential for cancer, birth defects, or other developmental abnormalities; substances with serious acute toxicity effects; and substances that undergo radioactive decay processes, resulting in the release of ionizing radiation.

4.7.2.3 Ambient Air Quality Standards

The U.S. Environmental Protection Agency (EPA) has established ambient air quality standards for several different pollutants, which are often referred to as criteria pollutants (see Table 4.7-1). Ambient standards for some of these pollutants have been set for both short and long time periods. Federal ambient air quality standards are based primarily on evidence of acute and chronic health effects. The State of Kentucky has adopted federal ambient air quality standards for criteria pollutants. In addition, the state has adopted standards for H_2S, gaseous fluorides, and odors. The state has also established a standard for total fluorides in and on forage consumed by grazing animals. These additional state air quality standards are summarized in Table 4.7-2.

Air pollutants can be categorized by the nature of their toxic effects including: (1) irritants (such as ozone, PM_{10}, NO_x, SO_x, sulfate particles, H_2S, and vinyl chloride) that affect the respiratory system, eyes, mucous membranes, or the skin; (2) asphyxiants (such as carbon monoxide [CO] and nitric oxide) that displace oxygen or interfere with oxygen transfer in the circulatory system, affecting the cardiovascular and central nervous systems; (3) necrotic agents (such as ozone, NO_x, and SO_x) that directly cause cell death; or (4) systemic poisons (such as lead particles) that affect a range of tissues, organs, and metabolic processes.

Ozone and particulate matter are the most common air pollution problems in most parts of the country, with CO being an additional pollutant of concern in urbanized areas. Ozone is a strong oxidizing agent that reacts with a wide range of materials and biological tissues. Ozone is also a respiratory irritant that can cause acute and chronic effects on the respiratory system. Recognized effects include reduced pulmonary function, pulmonary inflammation, increased airway reactivity, aggravation of existing respiratory diseases (such as asthma, bronchitis, and emphysema), physical damage to lung tissue, decreased exercise performance, and increased susceptibility to respiratory infections (Horvath and McKee 1994). In addition, ozone causes significant damage to leaf tissues of crops and natural vegetation. Ozone also damages many materials by acting as a chemical oxidizing agent. Because of its chemical activity, indoor ozone levels are usually much lower than outdoor levels.

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for meaningful time periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns.

Many components of suspended particulate matter are respiratory irritants. Some components (such as crystalline or fibrous minerals) are primarily physical irritants. Other components are chemical irritants (such as sulfates, nitrates, and various organic chemicals). Suspended particulate matter also can contain compounds (such as heavy metals and various organic compounds) that are systemic toxins or necrotic agents. Suspended particulate matter or compounds adsorbed on the surface of particles can also be carcinogenic or mutagenic chemicals.

Table 4.7-1. National Ambient Air Quality Standards

		National Ambient Air Quality Standards			
Pollutant	**Symbol**	**Averaging Time**	**Parts Per Million**	**Micrograms Per Cubic Meter**	**Violation Criteria**
Ozone	0_3	1 hour	0.12	235	If exceeded on more than 3 days in a 3-year period
		8 hours	0.08	157	If exceeded by the mean of annual 4th highest daily values for a 3-year period
Carbon Monoxide	CO	8-hours	9	10,000	If exceeded on more than 1 day per year
		1-hour	35	40,000	If exceeded on more than 1 day per year
Inhalable Particulate Matter	PM_{10}	Annual Arithmetic Mean	—	50	If exceeded as a 3-year single station average
		24 hours	—	150	If exceeded by the mean of annual 99th percentile values over 3 years
Fine Particulate Matter	$PM_{2.5}$	Annual Arithmetic Mean	—	15.0	If exceeded as a 3-year spatial average of data from designated stations
		24 hours	—	65	If exceeded by the mean of annual 98th percentile values over 3 years
Nitrogen Dioxide	NO_2	Annual Average	0.053	100	If exceeded
Sulfur Dioxide	SO_2	Annual Average	0.03	80	If exceeded
		24 hours	0.14	365	If exceeded on more than 1 day per year
		3 hours	0.5	1,300	If exceeded on more than 1 day per year
Lead Particles (TSP Sampler)	Pb	Calendar Quarter	—	1.5	If exceeded

Notes: All standards except the national PM_{10} and $PM_{2.5}$ standards are based on measurements corrected to 25 degrees C and 1 atmosphere pressure. The national PM_{10} and $PM_{2.5}$ standards are based on direct flow volume data without correction to standard temperature and pressure.
Decimal places shown for standards reflect the rounding precision used for evaluation compliance. Except for the 3-hour sulfur dioxide standard, the national standards shown are the primary (health effects) standards. The national 3-hour sulfur dioxide standard is secondary (welfare effects) standard. EPA adopted new ozone and particulate matter standards on July 18, 1997. The new standards have been challenged in court, and final appeals have not been decided. Thus, implementation of the new standards is on hold and remain under court review. Previous national PM_{10} standards (which had different violation criteria than the September 1997 standards) will remain in effect for existing PM_{10} nonattainment areas until EPA takes actions required by Section 172(e) of the *Clean Air Act* or approves emission control programs for the relevant PM_{10} state implementation plan. Violation criteria for all standards except the national annual standard for $PM_{2.5}$ are applied to data from individual monitoring sites. Violation criteria for the national annual standard for $PM_{2.5}$ are applied to a spatial average of data from one or more community-oriented monitoring sites representative of exposures at neighborhood or larger spatial scales (40 CFR Part 58). The "10" in PM_{10} and the "2.5" in $PM_{2.5}$ are not particle size limits; these numbers identify the particle size class (aerodynamic equivalent diameters in microns) collected with 50% mass efficiency by certified sampling equipment. The maximum particle size collected by PM_{10} samplers is about 50 microns aerodynamic equivalent diameter; the maximum particle size collected by $PM_{2.5}$ samplers is about 6 microns aerodynamic equivalent diameter.
TSP = total suspended particulates.
Sources: 40 CFR Parts 50, 53, and 58.

Table 4.7-2. Additional State of Kentucky Air Quality Standards

National Ambient Air Quality Standards				
Pollutant	**Averaging Time**	**Parts Per Million**	**Micrograms Per Cubic Meter**	**Violation Criteria**
Hydrogen Sulfide	1 hour (secondary)	0.01	14	If exceeded more than once per year
Gaseous Fluorides (as HF)	24 Hours (primary)	1.0	800	If exceeded more than once per year
	Annual Average (primary)	0.5	400	If exceeded
	12 Hours (secondary)	0.0045	3.68	If exceeded more than once per year
	24 Hours (secondary)	0.0035	2.86	If exceeded more than once per year
	1 Week (secondary)	0.0020	1.64	If exceeded more than once per year
	1 Month (secondary)	0.0010	0.82	If exceeded more than once per year
Total fluorides (F ion, dry weight basis in or on forage)	1 Month (secondary)	80		If exceeded
	2 Months (secondary)	60		If exceeded
	Growing Season Average (secondary)	40		If exceeded in samples over a period of up to 6 months
Odors	(secondary standard)			If detectable after 7:1 dilution of ambient air by odorless air

Note: Primary standards are based on public heath considerations: Secondary standards are based on protection of general welfare and property.
Source: Kentucky Administrative Regulations, Title 401, Chapter 53, Section 010.

Public health concerns focus on the particle size ranges likely to reach the lower respiratory tract or the lungs. Inhalable particulate matter represents particle size categories that are likely to reach either the lower respiratory tract or the lungs after being inhaled. Fine particulate matter ($PM_{2.5}$) represents particle size categories likely to penetrate to the lungs after being inhaled.

In addition to public health impacts, suspended particulate matter causes a variety of material damage and nuisance effects: abrasion; corrosion, pitting, and other chemical reactions on material surfaces; soiling; and transportation hazards due to visibility impairment.

Carbon monoxide is a public health concern because it combines readily with hemoglobin in the blood, and thus reduces the amount of oxygen transported to body tissues. Relatively low concentrations of CO can significantly affect the amount of oxygen in the bloodstream since CO binds to hemoglobin 200-250 times more strongly than oxygen. Both the cardiovascular system and the central nervous system can be affected when 2.5 to 4.0 percent of the hemoglobin in the blood is bound to CO rather than to oxygen (Goldsmith 1986; Gutierez 1982; McGrath 1982). Because of its low chemical reactivity and low solubility, indoor CO levels usually are similar to outdoor levels.

In July 1997, EPA revised the violation criteria for the existing PM_{10} standards, adopted a new 8-hour ozone standard, and adopted new $PM_{2.5}$ standards. In 1998, EPA rescinded the federal 1-hour ozone standard for areas that had achieved the standard. Due to ongoing litigation over the new 8-hour ozone standard, the 1-hour ozone standard was reinstated for all areas in July 2000. The previous PM_{10} standards will be rescinded (with the revised PM_{10} standards remaining in place) after emission control programs required by the previous standards are approved by EPA. The new particulate matter and ozone standards have been

challenged in court. Air quality management programs related to these standards are on hold pending final resolution of the court challenges.

4.7.2.4 Air Quality Planning

The federal *Clean Air Act* (CAA) requires each state to identify areas which have ambient air quality in violation of federal standards. States are required to develop, adopt, and implement a State Implementation Plan (SIP) to achieve, maintain, and enforce federal ambient air quality standards in these nonattainment areas. Deadlines for achieving the federal air quality standards vary according to air pollutant and the severity of existing air quality problems. The SIP must be submitted to and approved by EPA. SIP elements are developed on a pollutant-by-pollutant basis whenever one or more air quality standards are being violated.

The status of areas with respect to federal ambient air quality standards is categorized as nonattainment, attainment (better than national standards), unclassifiable, or attainment/cannot be classified. For most air pollutants, initial federal status designations are made using only two categories (either nonattainment and unclassifiable, or nonattainment and attainment/cannot be classified). For simplicity and clarity, the federal unclassifiable and attainment/cannot be classified designations will be called unclassified throughout this EIS. The unclassified designation includes attainment areas that comply with federal standards as well as areas for which monitoring data are lacking. Unclassified areas are treated as attainment areas for most regulatory purposes.

A formal attainment designation generally is used only for areas that transition from a nonattainment status to an attainment status. Areas that have been reclassified from nonattainment to attainment of federal air quality standards are automatically considered "maintenance areas," although this designation is seldom noted in status listings. Federal nonattainment designations for ozone, CO, and PM_{10} normally include subcategories indicating the severity of the air quality problem.

Clark County, Kentucky, is formally designated as an unclassified area for all of the major criteria pollutants. Because Clark County is in attainment for all criteria pollutants and has no maintenance area designations, CAA conformity requirements do not apply to federal agency actions related to the proposed project.

4.7.2.5 Regulatory Considerations

The 1970 amendments to the CAA established several regulatory programs, including: (1) adoption of emission standards for motor vehicles; (2) adoption of emission standards for major new industrial facilities (New Source Performance Standards [NSPS]); (3) adoption of emission standards for hazardous air pollutants (National Emission Standards for Hazardous Air Pollutants [NESHAPs]); and (4) preconstruction review of major new industrial facilities (New Source Review [NSR] for nonattainment areas, and Prevention of Significant Deterioration [PSD] for attainment areas).

The 1977 amendments to the CAA revised and expanded some of the regulatory programs established by the 1970 amendments. The 1990 amendments to the CAA made further revisions to the established regulatory programs and added a new program (Title V) involving operating permits for major industrial facilities.

In general, states have assumed primary responsibility for enforcing most industrial source emission standards and industrial source review requirements; EPA exercises formal review and oversight responsibilities. Most states have implemented the NSR, PSD, and Title V requirements as formalized air quality permit programs. The Kentucky Division of Air Quality administers air quality permit programs in Kentucky.

4.7.2.6 Existing Air Quality Conditions

The State of Kentucky currently does not have any air quality monitoring stations in Clark County. Data from monitoring stations in the Lexington urban area would not be representative of conditions in the project vicinity. Past air quality monitoring has shown the federal air quality standards are not violated in Clark County or adjacent counties. As noted previously, Clark County is considered to be in attainment for all of the National Ambient Air Quality Standards.

4.8 Water Resources and Water Quality

This section describes existing water resources, site hydrologic conditions, and water use.

4.8.1 Surface Water

The proposed project site is located within the Kentucky River Basin, one of 13 major river basins in the state, approximately 2.8 kilometers (1.75 miles) north of the Kentucky River at River Mile 188 (see Figure 4.8-1). At the project site, the Kentucky River is approximately 75 to 90 meters (250 to 300 feet) wide.

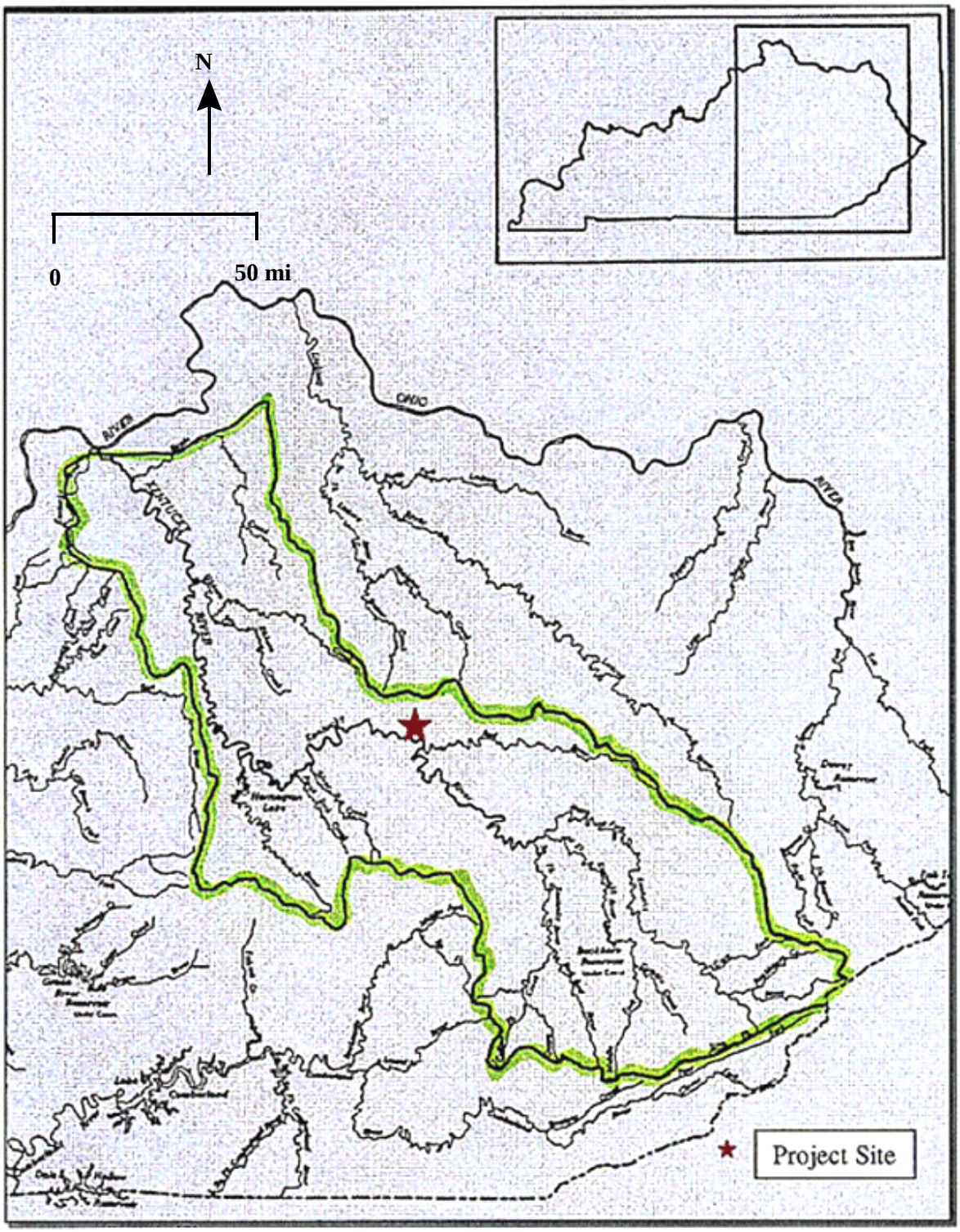
The total drainage area of the Kentucky River Basin is 18,042 square kilometers (6,966 square miles). The Kentucky River extends 407 kilometers (255 miles) from its source where the north and south forks meet near Beattyville, Kentucky, to its confluence with the Ohio River near Carollton, Kentucky. The river is a series of pools created by 14 locks and dams composing the navigation system maintained and operated by the U.S. Army Corps of Engineers (USACE). During periods of low flow, the river is stabilized by the impoundment system. As a result, instead of taking on the characteristics of a small stream, the river remains relatively deep and begins to resemble a lentic (still-water) aquatic system. During high flow periods, the river is characterized by rapid flow rates and undergoes rapid water level fluctuations.

The largest tributary to the Kentucky River near the project site is Upper Howard Creek. It is approximately 26 kilometers (16 miles) long with a drainage area of 6,780 hectares (16,753 acres). Cotton Creek is an intermittent tributary to Upper Howard Creek. The total drainage area of the Cotton Creek Basin is 298 hectares (736 acres). Bull Run is an intermittent tributary to the Kentucky River located near the project site that has a total watershed drainage area of 622 hectares (1,537 acres). Figure 4.8-2 indicates the locations of these waterbodies with respect to the project site.

The mean flow of the Kentucky River at Lock 10, located at River Mile 176.5 (18.5 kilometers [11.5 miles] downstream of the project site) for the years 1961 to 1999 is approximately 158 cubic meters per second (5,600 cubic feet per second) (USGS 2000). The J.K. Smith EA calculated the annual average flow at the site as 150 cubic meters per second (5,285 cubic feet per second), or 12.9 billion liters per day (3.4 billion gallons per day). The 7-day flow with a recurrence interval of 10 years is 4.3 cubic meters per second (152 cubic feet per second) or 371.5 million liters per day (98.2 million gallons per day) (UEC 1980).

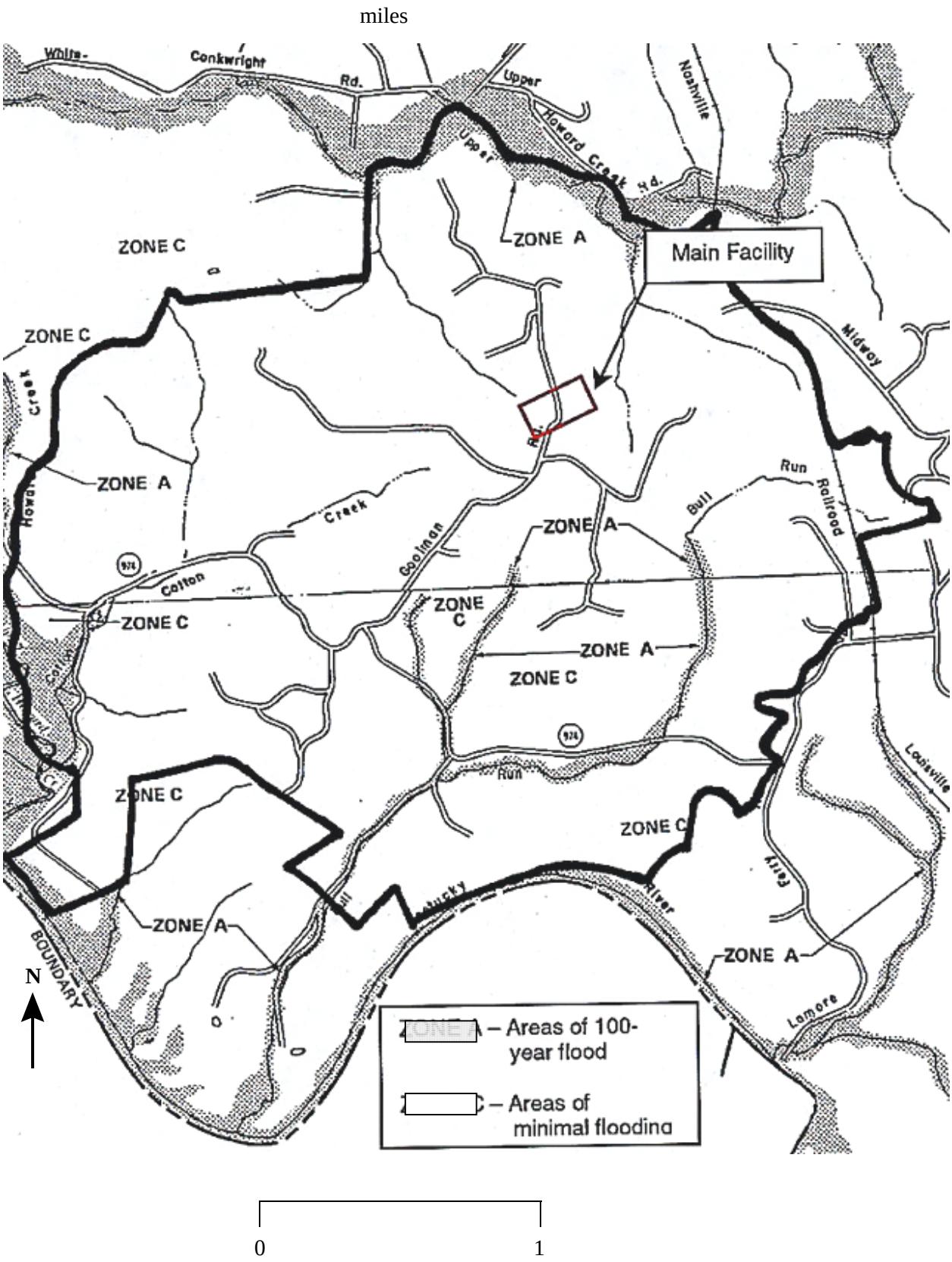
The State of Kentucky designates surface waters as having one or more specific legitimate uses. These uses are: Warm Water Aquatic Habitat; Cold Water Aquatic Habitat; Primary Contact Recreation; Secondary Contact Recreation; Domestic Water Supply; and Outstanding State Resource Water. The Kentucky River in the project vicinity is classified as Warm Water Aquatic Habitat, Primary and Secondary Contact Recreation, and Domestic Water Supply (401 Kentucky Administrative Regulations [KAR] 5:026). In order to maintain the river's specific use designation, the river must meet certain physical, chemical, and biological water quality characteristics. Near the project site, there are several industrial sources that discharge treated wastewater to the Kentucky River. All industrial wastewater sources must comply with the Kentucky Pollutant Discharge Elimination System (KPDES) permits to assist in maintaining the water quality standards and designations. The Kentucky River in the project vicinity fully supports all designated uses (KNREPC 2000).

Pursuant to Section 303(d) of the *Clean Water Act*, the State of Kentucky has developed a list of waterbodies presently not supporting designated uses. As required by 40 CFR 130.7(b)(4), these waters have been prioritized for total maximum daily load development. In the most recently available Section 303(d) list of impaired waters in the state, no such waterbodies were identified in Clark County (KDEP 1998).



Source: EIV 2000.

Figure 4.8-1. The Kentucky River Basin



Source: EIV 2000.

Figure 4.8-2. Location of Surface Waterbodies and Flood Zones

4.8.2 Groundwater

The groundwater in the area of the site is characterized by two zones: a perched groundwater level and the permanent regional groundwater table. The perched groundwater level exists where vertical migration of surface infiltration is halted by relatively impermeable strata. Piezometric levels in such a perched condition vary with time and reflect material zoning and characteristics. The limited water bearing capacity of the more permeable zones of jointed rock precludes long-term, high-volume seepage. Beneath the impermeable strata, at the level of the Kentucky River, lies the permanent regional groundwater table.

As mentioned in Section 4.6, Geology and Soils, during the initial site characterization two borings were completed at the project site. Bedrock was encountered at approximately 1.5 meters (5 feet) beneath the ground surface in both borings. Perched groundwater is indicated on the boring logs at a depth of 1.2 meters (4 feet). These borings were advanced to a depth of up to 18 meters (60 feet) and the regional groundwater table was not encountered.

Six groundwater wells were installed in the jointed bedrock to monitor the regional groundwater table during the initial site characterization. They were installed south and southeast of the project site within a 2.1-kilometer (1.3-mile) radius. The closest is located approximately 1 kilometer (0.6 miles) southeast of the project site. The water level elevation was approximately 216 meters (710 feet) above mean sea level in this well in August 1979. More recent data on the regional groundwater table elevation in this area is not available. However, since the on-site borings did not encounter groundwater at a depth of 18 meters (60 feet), which equates to 226 meters (740 feet) above mean sea level, it can be assumed that the regional groundwater table at the project site lies between 18 to 27 meters (60 to 90 feet) below the ground surface.

Because of the proximity of the project site to the Kentucky River, regional groundwater flow would be expected to be southerly towards the river. Available data support this theory. Although the placement of the six wells is not conducive to obtaining a reliable contour map of the groundwater table elevation, based on the reported groundwater elevations it appears that regional groundwater flow is southerly towards the Kentucky River.

Permeability tests were conducted on the monitoring wells and results ranged from $2x10^{-3}$ to $8x10^{-6}$ centimeters per second. Groundwater velocities were estimated to be on the order of $1x10^{-6}$ centimeters per second (UEC 1980).

Groundwater samples were collected from the six wells and analyzed for chemical parameters. Measured parameters indicated that overall water quality varied widely from well to well. Total dissolved solids exceeded drinking water standards in every well, hydrogen sulfide was detected in each well, and chloride and salinity levels were above those normally considered acceptable for drinking water. Bicarbonate, dissolved oxygen, biochemical oxygen demand, coliform, and nitrate levels varied widely between wells. However, measurements of these parameters at the well closest to the project site were within applicable standards.

Groundwater from depths greater than 15 meters (50 feet) in Clark County is typically highly mineralized, often containing objectionable levels of salt, hydrogen sulfide, and iron (KGS 2001).

In order to identify any existing information on regional groundwater quality in the area, a search of the Kentucky Geological Survey's Groundwater Repository database was conducted. Sixty-nine wells were identified within a 10-kilometer (6-mile) radius of the project site. None of these wells are located within the EKPC property. Water quality data as recent as the late 1990s is available for several of the wells identified. Parameters analyzed in most samples included metals, pesticides, polychlorinated biphenyls (PCBs), and basic water quality parameters such as total dissolved and suspended solids, pH, nitrate, and chloride. Several samples were also analyzed for volatile organic compounds such as trichloroethylene. No

pollutants, such as pesticides, PCBs, or volatile organic chemicals, were detected. The overall water quality of most samples was comparable to that discussed above for the wells installed as part of the initial site characterization.

4.8.3 Floodplains

Based on the Federal Emergency Management Agency Flood Insurance Map, the main project site lies completely within Zone C and is therefore not within a 100-year floodplain (see Figure 4.8-2). The project site also lies above the 500-year floodplain.

The existing water intake and discharge structures are located within the Kentucky River, and as such are not considered to be in the 100-year floodplain. The proposed modifications to these structures and all construction required for the project would not take place within a floodplain.

4.8.4 Wetlands

The Natural Resources Conservation Service branch of the U.S. Department of Agriculture has the responsibility of making wetland determinations on agricultural and non-agricultural lands that contact land currently used for agricultural purposes. The USACE has the responsibility for certifying all other non-agricultural land, including wetlands. Based on the data provided by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory Program, there are no wetlands located on the proposed main facility site. However, within the rail loop, a few wetland areas were indicated by a USFWS aerial survey completed in the early to mid-1980s. Within this same time period EKPC was conducting extensive cut and fill operations at the site. A recent survey by an EKPC wetlands biologist found that there were no wetlands within the project area (KPE 2001). In addition, the site is not within a 100-year floodplain (an area subject to a 1 percent chance of flooding in any given year). The site would best be described as an "old field" (EKPC 2000a).

4.8.5 Water Use

Except for agricultural users, large users (greater than 10,000-gallons per day) of water in Kentucky are required to obtain a water withdrawal permit from the Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection's Division of Water. As a permit holder, these facilities are required to report actual water withdrawals. Under Kentucky law, however, steam electric power generating facilities regulated by the Public Service Commission are exempt from this permitting process. As a result, an accurate inventory of the volume of water being removed each day by the existing power plants is not available.

According to the Kentucky Division of Water, approximately 3,459.93 million liters (914.02 million gallons) per day of water was withdrawn in Kentucky by permitted sources including water suppliers, mining, industrial and commercial (self-supplied facilities), and aquaculture users in 2001. This total does not include estimated amounts of water used for power production. Hydroelectric power is estimated to use 314 billion liters per day (83 billion gallons per day), but virtually all of it is returned to the sources from which it is obtained. Thermoelectric power production withdraws an estimated 12.87 billion liters per day (3.4 billion gallons per day), of which 768.4 million liters (203 million gallons) are consumed (KDEP 2002).

The cumulative effects of withdrawals from the Kentucky River by power plants have been discussed by the Kentucky Natural Resources and Environmental Protection Cabinet in their cumulative assessment report. When issuing permits for water withdrawal, in order to ensure that sufficient flow is reserved for allocation to future users and to maintain water quality and stream habitat, the Division of Water allocates no more than 10 percent of a stream's lowest average monthly flow to any one user. During low flow conditions, potential conflicts could exist between competing water users. In order to minimize these conflicts, the Division of Water is able to limit withdrawals from permitted sources if necessary (KNREPC 2001).

4.9 Ecological Resources

The following ecological resources description and discussion is intended to provide the reader with a general overview of the biota present within the region and at the proposed site location. The J.K. Smith EIS addressed construction of a power plant within the 1,263-hectare (3,120-acre) J.K. Smith Site with the project complex to be a 121-hectare (300-acre) parcel of land located in the northeast portion of the site. The J.K. Smith Units 1 and 2 were never constructed; however, the 121-hectare (300-acre) site was cleared, and construction of rail facilities, foundations, and infrastructure were completed before the project was halted (EIV 2000). The currently proposed Kentucky Pioneer IGCC Demonstration Project consists of a 4.8-hectare (12-acre) process area proposed for construction and operation within this same previously disturbed 121-hectare (300-acre) portion (EIV 2000). The proposed site has not changed appreciably in the 20-year period since the Final J.K. Smith EIS was prepared (EKPC 2000a, EIV 2000). As previously acknowledged, much of the site was graded before construction was halted. The entire project site has been previously disturbed either from historic agricultural practices or the previous power station site preparation (EKPC 2000a). More specifically, the Kentucky Pioneer IGCC Demonstration Project would be developed on that portion of the site previously cleared (EIV 2000). Figures 3.1-3 to 3.1-6 illustrate the current site conditions.

The route of the proposed new 27-kilometer (17-mile) transmission line has not been determined. It will be constructed within the flora (vegetation) and fauna (animals) communities described in the following sections. Ecological resource descriptions will be provided in separate NEPA documentation that will be prepared in accordance with the Rural Utility Service's regulations.

4.9.1 Flora

Kentucky is located entirely within the deciduous forest formation of eastern North America and in an area described for eastern Kentucky as Mixed Mesophytic Forest and throughout most of central and western Kentucky as Western Mesophytic Forest. The diverse vegetation of Kentucky is largely a function of the diverse geology and soils. An estimated 40 percent of Kentucky remains forested and in a natural or semi-natural condition (GAP 1998).

The proposed project site lies within the eastern deciduous forest formation, in the ecological transitional area between the Knobs border area of the Mixed Mesophytic Forest region and the Bluegrass section of the Western Mesophytic Forest region. Little original vegetation remains in the Bluegrass section and in the Knobs/Bluegrass transitional area. A range of environmental variables, such as those provided by micro sites ranging from xeric (dry) exposed hilltops to mesic (moist) sheltered coves, determines the abundance and distribution of the dominant plant species. Major vegetation communities near the site consist of mature wooded communities on uplands and slopes, successional stages of these communities, pasture, cropland, and abandoned cropland. Most of the land within an 8-kilometer (5-mile) radius has been logged or grazed during some period since European settlement. Wooded riparian communities and lowland communities cover relatively small areas (REA 1980).

The proposed site location was previously used for agricultural purposes and further disturbed by limited construction of the cancelled power project described above. It is a fescue (grass) dominated xeric (dry) ridgetop typical of the Bluegrass Region. Nearby slopes are characterized by the presence of red cedar interspersed with patches of prairie remnant. There are no jurisdictional wetlands present on the proposed main facility site.

Riparian vegetation is present along the Kentucky River and adjacent to the existing water intake and discharge points (KPE 2001). The current effluent line discharges to the Kentucky River are in accordance with Kentucky Department of Environmental Protection regulations (KPE 2001). Canopy vegetation is typified by sycamore (*Plantanus occidentalis*), boxelder (*Acer negundo*), and silver maple (*Acer saccharinum*).

4.9.2 Fauna

White-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*) are the larger mammals present. The red fox (*Vulpes fulva*), gray fox (*Urocyon cinereoargenteus*), Virginia opossum (*Didelphis marsupialis*), woodchuck (*Marmota monax*), fox squirrel (*Sciurus niger*), red squirrel (*Tamiasciurus hudsonicus*), grey squirrel (*Sciurus carolinensis*) eastern cottontail (*Sylvilagus floridanus*), eastern chipmunk (*Tamias striatus*), muskrat (*Ondatra zibethica*), white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*) are representative of the small mammals found in the state.

Among the great variety of resident birds found in Kentucky are the cardinal (*Cardinalis cardinalis*), which is the State bird, and the blue jay (*Cyanocitta cristata*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), crow (*Coruus brachyrhynchos*), white-breasted nuthatch (*Sitta carolinensis*), several species of hawks, owls, woodpeckers, and sparrows. Common migratory birds include the catbird (*Dumetella carolinensis*), brown thrasher (*Toxostoma rufum*), great crested flycatcher (*Myiarchus crinitus)*, slate-colored junco (*Junco hyemalis*), golden-crowned kinglet (*Regulus satrapa*), yellow-bellied sapsucker (*Sphyrapicus varius)*, cedar waxwing (*Bombycilla cedrorum*), and many species of warbler. Popular game birds include the bobwhite (*Colinus virginianus*), quail woodcock (*Philohela minor*), ring-necked pheasant (*Phasianus colchicus*), rock dove (*Columba livia*), wild turkey (*Meleagris gallopavo*), and waterfowl (Microsoft Encarta 2000). A study in adjacent Madison County recorded 159 bird species of which 88 breed in the area (REA 1980).

There is a fairly rich diversity of amphibians and reptiles in Kentucky consisting of approximately 99 species. Common amphibians include the newt (*Notophthalmus viridescens*), dusky salamander (*Desmognathus fuscus*), bullfrog (*Rana catesbeiana*), American toad (*Bufo americanus*), and spring peeper (*Pseudacris crucifer*); common reptiles include the snapping turtle (*Chelydra serpentina*), box turtle (*Terrapene carolina*), painted turtle (*Chrysemys picta*), and five-lined skink (*Eumeces fasciatus*). The most widespread snakes include the eastern garter snake (*Thamnophis sirtalis*), northern water snake (*Nerodia sipedon*), and black rat snake (*Elaphe obsoleta*). Poisonous snakes include the timber rattlesnake (*Crotalus horridus*), cottonmouth (*Agkistrodon piscivorus*), and copperhead (*Agkistrodon contortrix*) (REA 1980).

Kentucky's fish fauna is more diverse than that of all other states except Tennessee and Alabama. The Kentucky River has 115 native species. The pools of the river support excellent warm water fisheries featuring crappie (*Pomoxis*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), small mouth black bass (*Micropterus dolomieu*), and catfish. In addition, muskellunge (*Esox Masquinongy*) and rainbow trout (*Oncorhynchus mykiss*) have been introduced. Similarly, Kentucky contains a rich diversity of mussel species with only Tennessee and Alabama having more. This group of organisms is the most endangered in Kentucky and the Nation. Approximately 56 percent of the Kentucky mussel species are found in the Kentucky River Basin (KNREPC 2000). Fauna present at the project site are typical of those found in similar habitats within the Knobs/Bluegrass transitional area.

4.9.3 Threatened, Endangered, and Sensitive Species

Correspondence received from the USFWS indicated that no federally-listed or proposed endangered or threatened species occur within the impact area of the project area (USFWS 2000a). The running buffalo clover (*Trifolium stoloniferum*) is a species which is listed as endangered under the *Endangered Species Act*. The USFWS has recommended that this species be evaluated for potential impacts resulting from the proposed project (USFWS 2000b). Table 4.9-1 is a compilation of special interest species listed by the Kentucky State Nature Preserves Commission as potentially occurring in Clark County.

Table 4.9-1. Potentially Occurring Special Interest Species in Clark County

Taxonomic Group	Scientific Name	Common Name	Statuses KY/Federal	Ranks
Plant	*Lesquerella globosa*	Lesquereux's Bladderpod	T/C	G2/S2
Plant	*Liparis loeselii*	Loesel's Twayblade	T	G5/S2/S3
Plant	*Malvastrum hispidum*	Hispid Falsemallow	T	G5/S2
Plant	*Rubus whartoniae*	Wharton's Dewberry	T	G2/S2
Plant	*Salix amygdaloides*	Peach-leaved Willow	H	G5/SH
Plant	*Schizachne purpurascens*	Purple Oat	T	G5/S2
Plant	*Spiranthes lucida*	Shining Ladies'-tresses	T	G5/S2/S3
Plant	*Stellaria fontinalis*	Water Stitchwort	T	G3/S1/S2
Plant	*Trichostema setaceum*	Narrowleaf Bluecurls	E	G5/S1/S2
Plant	*Trifolium stoloniferum*	Running Buffalo Clover	T/LE	G3/S2/S3
Plant	*Viola walteri*	Walter's Violet	T	G4/G5/S1/S2
Bivalve	*Villosa lienosa*	Little Spectaclecase	S	G5/S3/S4
Crustacean	*Cambarus veteranus*	A Crayfish	S	G3/S1
Insect	*Speyeria idalia*	Regal Fritillary	H	G3/SH
Bird	*Ammodramus henslowii*	Henslow's Sparrow	S	G4/S3
Bird	*Chondestes grammacus*	Lark Sparrow	T	G5/S2/S3
Bird	*Dolichonyx oryzivorus*	Bobolink	S	G5/S2/S3
Bird	*Nycticorax nycticorax*	Black-crowned Night-heron	T	G5/S1/S2
Mammal	*Mustela nivalis*	Least Weasel	S	G5/S2/S3

Kentucky State Nature Preserves Commission status:
E = Endangered, T = Threatened, S = special concern, H = historic
U.S. Fish and Wildlife Service status:
C = candidate for federal listing, LE = listed as endangered
Ranks:
G-RANK: Estimate of species abundance on a global scale:
G1 = extremely rare, G2 = rare, G3 = uncommon, G4 = common, G5 = very common,
S-RANK: Estimate of species abundance in Kentucky:
S1 = extremely rare, S2 = rare, S3 = uncommon, S4 = many occurrences, S5 = very common, SH = historically known in state
Source: KSNPC 2000.

4.10 Noise

This section discusses the noise levels at the proposed Kentucky Pioneer IGCC Demonstration Project site.

4.10.1 Noise Terminology

Sound is caused by vibrations that generate waves of air pressure fluctuations in the air. Air pressure fluctuations that occur from 20 to 20,000 times per second can be detected as audible sound. The number of pressure fluctuations per second is normally reported as cycles per second or Hertz. Different vibrational frequencies produce different tonal qualities for the resulting sound. In general, sound waves travel away from the noise source as an expanding spherical surface. The energy contained in a sound wave is consequently spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source.

Sound level meters typically report measurements as a composite decibel (dB) value. Decibel scales are a logarithmic index based on ratios between a measured value and a reference value. In the field of atmospheric acoustics, dB scales are based on ratios of the actual pressure fluctuations generated by sound waves compared to a standard reference pressure value of 20 micropascals (4.18×10^{-7} pounds per square foot).

Modern sound level meters measure the actual air pressure fluctuations at a number of different frequency ranges, most often using octave or 1/3 octave intervals. The pressure measurements at each frequency interval are converted to a decibel index and adjusted for a selected frequency weighting system. The adjusted decibel values for the different octave or 1/3 octave bands are then combined into a composite sound pressure level for the appropriate decibel scale.

Human hearing varies in sensitivity for different sound frequencies. The ear is most sensitive to sound frequencies between 800 and 8,000 Hertz, and is least sensitive to sound frequencies below 400 Hertz or above 12,500 Hertz. Several different frequency weighting schemes have been developed, using different dB adjustment values for each octave or 1/3 octave interval. Some of these weighting schemes are intended to approximate the way the human ear responds to noise levels; others are designed to account for the response of building materials to airborne vibrations and sound. The most commonly used decibel weighting schemes are the A-weighted and C-weighted scales.

The "A-weighted" decibel scale (dBA) is normally used to approximate human hearing response to sound. The dBA scale significantly reduces the measured pressure level for low frequency sounds while slightly increasing the measured pressure level for some middle frequency sounds. The "C-weighted" decibel scale (dBC) is often used to characterize low frequency sounds capable of inducing vibrations in buildings or other structures. The dBC scale makes only minor reductions to the measured pressure level for low frequency components of a sound while making slightly greater reductions to high frequency components than does the dBA scale.

4.10.2 Common Noise Descriptors

Varying noise levels are often described in terms of the equivalent constant decibel level. Equivalent noise levels (L_{eq}) are used to develop single-value descriptions of average noise exposure over various periods of time. Such average noise exposure ratings often include additional weighting factors for annoyance potential due to time of day or other considerations. The L_{eq} data used for these average noise exposure descriptors are generally based on dBA sound level measurements, although other weighting systems are used for special conditions (such as blasting noise).

Average noise exposure over a 24-hour period is often presented as a day-night average sound level (L_{dn}). L_{dn} values are calculated from hourly L_{eq} values, with the L_{eq} values for the nighttime period (10 p.m. to 7 a.m.) increased by 10 dB to reflect the greater disturbance potential from nighttime noises. Unless specifically noted otherwise, L_{dn} values are assumed to be based on dBA measurements.

4.10.3 Working With Decibel Values

The nature of dB scales is such that individual dB ratings for different noise sources cannot be added directly to give the dB rating of the combination of these sources. Two noise sources producing equal dB ratings at a given location will produce a composite noise level 3 dB greater than either sound alone. When two noise sources differ by 10 dB, the composite noise level will be only 0.4 dB greater than the louder source alone. Most people have difficulty distinguishing the louder of two noise sources that differ by less than 1.5 to 2 dB. In general, a 10 dB increase in noise level is perceived as a doubling in loudness. A 2 dB increase represents a 15 percent increase in loudness, a 3 dB increase is a 23 percent increase in loudness, and a 5 dB increase is a 41 percent increase in loudness.

When distance is the only factor considered, sound levels from an isolated noise source will typically decrease by about 6 dB for every doubling of distance away from the noise source. When the noise source is essentially a continuous line (e.g., vehicle traffic on a highway), noise levels decrease by about 3 dB for every doubling of distance.

4.10.4 Guidelines for Interpreting Noise Levels

The federal *Noise Control Act* of 1972 (Public Law 92-574) established a requirement that all federal agencies must administer their programs in a manner that promotes an environment free from noise that jeopardized public health or welfare. The EPA was given the responsibility for providing information to the public regarding identifiable effects of noise on public health or welfare, publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety, coordinating federal research and activities related to noise control, and establishing federal noise emission standards for selected products distributed in interstate commerce. The federal *Noise Control Act* also directed that all federal agencies comply with applicable federal, state, interstate, and local noise control regulations.

Although EPA was given major public information and federal agency coordination roles, each federal agency retains authority to adopt noise regulations pertaining to agency programs. EPA can require other federal agencies to justify their noise regulations in terms of the federal *Noise Control Act* policy requirements. The Occupational Safety and Health Administration (OSHA) retains primary authority for setting workplace noise exposure standards. Due to aviation safety considerations, the Federal Aviation Administration retains primary jurisdiction over aircraft noise standards.

To coordinate with the requirements of the federal *Noise Control Act*, EPA has identified indoor and outdoor noise limits to protect public health and welfare (hearing damage, sleep disturbance, and communication disruption) (EPA 1971). Outdoor L_{dn} values of 55 dB and indoor L_{dn} values of 45 dB are identified as desirable to protect against speech interference and sleep disturbance for residential, educational, and health care areas. Noise level criteria to protect against hearing damage in commercial and industrial areas are identified as 24-hour L_{eq} values of 70 dB (both outdoors and indoors).

The U.S. Department of Housing and Urban Development has established guidelines for evaluating noise impacts on residential projects seeking financial support under various grant programs (44 *Federal Register* [FR] 135). Sites are generally considered acceptable for residential use if they are exposed to outdoor L_{dn} values of 65 dB or less. Sites are considered "normally unacceptable" if they are exposed to

outdoor L_{dn} values of 65-75 dB. Sites are considered unacceptable if they are exposed to outdoor L_{dn} values above 75 dB.

4.10.5 Existing Noise Conditions

Studies conducted in 1979 for the J.K. Smith Power Station included ambient noise monitoring at several locations on or near the EKPC property. Locations that were not influenced by highway traffic had L_{dn} levels of 39 to 55 dBA (UEC 1980). Locations along Kentucky Highway 89 had L_{dn} levels of 52 to 69 dBA (UEC 1980). Average daytime noise levels were generally similar to or slightly higher than the L_{dn} values. Average nighttime noise levels were typically much lower than daytime values, often being close to 30 dBA. The noise levels reported for the project vicinity during 1979 are typical of quiet rural areas. EKPC has constructed four 80-MW combustion turbine units near the Kentucky Pioneer IGCC Demonstration Project Site, and is proposing a fifth unit. Noise monitoring conducted by EKPC since 1992 confirms that the noise data collected in 1979 are still representative of ambient noise conditions. The measured noise level at the perimeter of the EKPC combustion turbine site was 39 dBA on July 30, 1999, with three turbine units in operation.

4.11 Traffic and Transportation

This section discusses the major road and rail transportation routes to the proposed project site. Existing traffic levels are discussed for each method of transportation.

4.11.1 Roadways

The primary access routes to the ROI are Interstates 64 and 75. Interstate 64 is the main east-west artery and passes through Clark and Fayette Counties and the town of Winchester. Interstate 75 is the main north-south artery and passes through Fayette and Madison Counties. Kentucky Highway 627, a two-lane road, is the major north-south access road through Clark County and intersects with Interstate 64 in Winchester. Winchester is the location of the major interchanges for access to the project site. The community of Trapp is typically reached by traveling south from Winchester on Kentucky Highway 89, a two-lane road, for approximately 20.8 kilometers (13 miles). Kentucky Highway 974, another two-lane road, is an alternate route to Trapp from Winchester; however, the road switches from high type paved road to intermediate type paved road approximately 10.4 kilometers (6.5 miles) from Winchester. Trapp can also be accessed by heading east on the two-lane Kentucky Highway 52 from Richmond, in Madison County, and then traveling north on Kentucky Highway 89. The lack of bridges across the Kentucky River near the project location restricts access to the site from other highways. Kentucky Highways 1028 and 3369 are the other main roads in the vicinity of Trapp. The project site is serviced by an approximately 1.6-kilometer (1-mile) long access road that extends west from Kentucky Highway 89. No traffic control devices are in place at the intersection of the access road and Kentucky Highway 89.

Current and recent daily traffic loads for roads from Winchester and Madison to Trapp are presented in Table 4.11-1 at the end of this section. All data was obtained from the Kentucky Transportation Cabinet's Traffic Counts searchable database computer program, which provides historic traffic count data for Interstates and Kentucky and County Highways throughout the state (CTS 2001). The Actual Count data presented in the table is the average number of car trips per 24 hours for that particular road segment. The mileposts (MP) presented in the table are those established by the Kentucky Transportation Cabinet for the purposes of collecting traffic counts. The site access road intersects Kentucky Highway 89 between MP 2.9 and MP 4.8. Data is only presented to MP 9.7 for Kentucky Highway 974 because the highway turns to the north at that point while Red River Road continues southeast toward the community of Trapp. No traffic studies are available for Red River Road. Data for Kentucky Highway 52 is presented from the intersection with Interstate 75 to the intersection with Kentucky Highway 89 in Estill County. Capacity data for Kentucky Highways is unavailable as no capacity studies have been completed.

4.11.2 Railroads

The project site is located approximately 0.8 kilometer (0.5 mile) west of a 198-kilometer (123-mile) freight rail line segment that runs between Winchester and Typo, Kentucky. The line segment, identified as number C-273, is owned and operated by CSX Transportation, Inc., of Jacksonville, Florida, and has been operating in the region for an extended period of time. Existing rail traffic data for the line as reported in the *Proposed Conrail Acquisition Final Environmental Impact Statement* averages 13.1 freight trains per day (STB 1998). An approximately 5-kilometer (3.1-mile) long rail loop extends from the main freight line into the J.K. Smith Site. The project site also contains extensive rail yard capacity that is linked to the rail loop at several locations.

Table 4.11-1. Traffic Levels for Main Roads Approaching and Located in Trapp, Kentucky

Highway Number	Functional Class	City	County	Beginning MP	Ending MP	Actual Count	Year	Estimated Count, 2001
			Winchester to Trapp					
89	Rural- Major Collector	Trapp	Clark	2.9[c]	4.8	1,554	2000	1,520
89	Rural- Major Collector	N/A	Clark	4.8	9.2	2,252	2000	2,270
89	Rural- Major Collector	N/A	Clark	9.2	12.6	2,642	2000	2,690
89	Rural- Major Collector	N/A	Clark	12.6	13.7	3,730	2000	3,680
89	Rural- Major Collector	Winchester	Clark	13.7	14.9	3,880	1995	4,110
89	Urban- Minor Arterial	Winchester	Clark	14.9	15.4	6,743	1995	6,240
89	Urban- Minor Arterial	Winchester	Clark	15.4	16.0	10,192	1995	10,600
974	Urban- Minor Arterial	Winchester	Clark	0.0	0.2	4,163	1999	4,210
974	Urban- Minor Arterial	Winchester	Clark	0.2	0.4	2,226	1995	2,370
974	Urban- Minor Arterial	Winchester	Clark	0.4	1.0	2,516	1999	2,540
974	Rural- Minor Collector	Winchester	Clark	1.0	3.1	1,745	1995	1,900
974	Rural- Minor Collector	N/A	Clark	3.1	4.0	1,080	1999	1,110
974	Rural- Minor Collector	N/A	Clark	4.0	6.5	630	1995	669
974	Rural- Minor Collector	N/A	Clark	6.5	9.7	200	1999	211
			Richmond to Trapp					
52	Urban- Other Principal Arterial	N/A	Madison	8.3	10.5	8,023	1997	8,400
52	Urban- Other Principal Arterial	Richmond	Madison	10.5	10.8	13,189	1997	13,100
52	Urban- Other Principal Arterial	Richmond	Madison	10.8	10.9	15,907	2000	16,000
52	Urban- Minor Arterial	Richmond	Madison	10.9	11.2	18,390	1998	19,800
52	Urban- Minor Arterial	Richmond	Madison	11.2	11.4	29,090	1997	31,600
52	Urban- Minor Arterial	Richmond	Madison	11.4	11.9	21,281	1997	22,100
52	Urban- Minor Arterial	Richmond	Madison	11.9	12.2	5,493	1997	5,140
52	Urban- Minor Arterial	Richmond	Madison	12.2	13.0	6,636	2000	6,800
52	Urban- Minor Arterial	Richmond	Madison	13.0	13.9	18,023	2000	18,400
52	Rural- Major Collector	N/A	Madison	13.9	15.4	16,738	2000	17,100
52	Rural- Major Collector	N/A	Madison	15.4	17.8	13,209	2000	13,600
52	Rural- Major Collector	N/A	Madison	17.8	19.8	10,143	1998	10,800
52	Rural- Major Collector	N/A	Madison	19.8	22.9[a]	8,022	1998	8,550
52	Rural- Major Collector	N/A	Estill	0.0[a]	2.1	7,332	1998	7,930
52	Rural- Major Collector	N/A	Estill	2.1	3.7	9,427	1999	10,200
52	Rural- Major Collector	N/A	Estill	3.7	5.4	7,357	1999	8,240
52	Rural- Major Collector	N/A	Estill	5.4	5.9	11,434	1999	11,900
52	Rural- Major Collector	Irvine	Estill	5.9	6.7	10,711	1998	12,500
52	Rural- Major Collector	Irvine	Estill	6.7	7.6	18,284	1999	19,000
89	Rural- Major Collector	Irvine	Estill	11.3	11.4	19,734	1996	22,300
89	Rural- Major Collector	Irvine	Estill	11.4	11.5	13,905	1999	14,200
89	Rural- Major Collector	Irvine	Estill	11.5	11.6	13,132	1999	13,200
89	Rural- Major Collector	Irvine	Estill	11.6	11.8	16,277	1999	16,800
89	Rural- Major Collector	Irvine	Estill	11.8	11.9	7,059	1998	8,410
89	Rural- Major Collector	Irvine	Estill	11.9	13.0	13,209	1996	13,800
89	Rural- Major Collector	N/A	Estill	13.0	14.2	6,419	1997	6,470
89	Rural- Major Collector	N/A	Estill	14.2	17.9	4,498	1998	4,830
89	Rural- Major Collector	N/A	Estill	17.9	18.6	1,749	1999	1,870
89	Rural- Major Collector	N/A	Estill	18.6	22.5[b]	1,269	2000	1,250
89	Rural- Major Collector	N/A	Clark	0.0[b]	2.9[c]	1,269	2000	1,250
			Trapp					
1028	Rural- Local	N/A	Clark	0.0	1.7	182	1999	191
1028	Rural- Local	N/A	Clark	1.7	4.0	118	2000	112
3369	Rural- Minor Collector	N/A	Clark	0.0	1.3	440	1999	450
3369	Rural- Minor Collector	N/A	Clark	1.3	2.6	593	1995	611

Note: The MPs on Highways 89 and 974 in Clark County run in opposite directions. Highway 89 terminates in Winchester while Highway 974 originates in Winchester.
[a]MP 0.0 on Highway 52 in Estill County is the same as MP 22.9 in Madison County (Estill/Madison Border).
[b]MP 0.0 on Highway 89 in Clark County is the same as MP 22.5 in Estill County (Clark/Estill Border).
[c]MP2A on Highway 89 is the closest measurement interval to the project site entrance.
Source: CTS 2001.

4.12 Occupational and Public Health and Safety

This section discusses the regulations of worker and public health and safety, and the existing hazards at the proposed project site.

4.12.1 Regulatory Considerations

Occupational health and safety issues are primarily the responsibility of OSHA. OSHA regulations applicable to the construction and operation activities at the proposed site include 29 CFR 1910 and 29 CFR 1926. The State of Kentucky has supplemental worker safety requirements. The EPA and the State of Kentucky have primary regulatory jurisdiction over hazardous waste management issues. Separate hazardous waste management programs and requirements exist for solid and liquid wastes, wastewater discharges, and air releases of hazardous materials.

4.12.2 Existing Hazard Conditions

Although the proposed project site was previously disturbed by preliminary grading and some foundation construction work, there are no developed facilities at the site. Thus, there are no existing worker or public safety hazards associated with industrial chemicals at the site. Conditions related to air quality, water quality, noise, geologic conditions, and transportation systems are discussed in previous sections.

The most recent available data on health status for Clark and Madison Counties show that the leading causes of death in the population are diseases of heart (31.4 percent) and malignant neoplasms (23.6 percent). For malignant neoplasm-related fatalities, lung cancer was the leading cause of death (KDPH 2000). In 1998, there were 118 fatal occupational injuries in the state, 30 agricultural and 88 non-agricultural. Fatal injuries decreased by 13 percent for agricultural and 27 percent for non-agricultural in 1998 compared to 1997. There were an estimated 49,091 nonfatal occupational injuries reported in 1998, 649 agricultural and 48,442 non-agricultural. Nonfatal agricultural and non-agricultural injuries reported in 1998 increased by 8.4 and 9 percent, respectively, compared to 1997.

4.13 Waste Management

There are no ongoing waste management activities at the proposed project site. There are no contained solid waste landfills in Clark County. The closest contained solid waste landfills to the proposed project site are in Estill (Blue Ridge Recycling & Disposal) and Montgomery (Montgomery County Landfill) Counties. Blue Ridge Recycling & Disposal accepts solid waste and some special wastes. This landfill has an expected life of approximately 22 years. The Montgomery County Landfill accepts construction debris, municipal solid waste, and all types of special waste. Its expected life is approximately 15.5 years; however, a horizontal expansion study is currently being conducted which may result in a doubling of landfill space and an increase in expected life. In addition, there are numerous solid waste facilities located in the State of Kentucky. There are no hazardous waste landfills in Kentucky.

5. ENVIRONMENTAL IMPACTS

5.1 Introduction

This chapter analyzes the potential impacts to human and environmental resources resulting from construction and operation of the proposed Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project at the J.K. Smith Site in Trapp, Kentucky. Analyses of the potential impacts resulting from the two No Action Alternatives are also provided.

5.2 Land Use

This section discusses the potential effects of the construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility on land use at the project site and surrounding areas.

5.2.1 Methodology

The land use resources analysis considers a region of influence (ROI) that includes the 121-hectare (300-acre) project site, as well as the rest of the J.K. Smith Site and surrounding areas. The land use resources analysis also considers an ROI that assumes a proposed route for a 138-kilovolt (kV) transmission line that extends northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky. Potential impacts to land use resources were qualitatively assessed by comparing potential land use changes to the existing land use patterns, plans, and policies.

5.2.2 Land Use Impacts from No Action Alternative 1

Under No Action Alternative 1, the U.S. Department of Energy (DOE) would not provide partial funding for the design, construction, and operation of the proposed project. Because no new construction would occur, there would be no impacts to land use resources.

5.2.3 Land Use Impacts from No Action Alternative 2

Under No Action Alternative 2, the natural gas-fired combined-cycle units process area would occupy approximately 4.8 hectares (12 acres) of the 121-hectare (300-acre) project site leased to Kentucky Pioneer Energy, LLC (KPE), from the East Kentucky Power Cooperative (EKPC). The project would affect approximately 5 to 8 hectares (12 to 20 acres), all of which is located within the 121-hectare (300-acre) site. The process area has been previously disturbed by EKPC during the initial site preparation for the abandoned construction of the J.K. Smith Power Station in the early 1980s. Preliminary grading and some foundations were completed in the area. The site was originally prepared for a power station that was never completed due to a decrease in the demand for electricity at that time. No effects on surrounding land uses are expected to occur from the construction and operation of the natural gas-fired combined-cycle units. The Winchester-Clark County Planning Commission does not consider utility structures when determining zoning for an area. Therefore, the project area will remain zoned agricultural.

The proposed 138-kV transmission line would be approximately 27 kilometers (17 miles) in length; however, the exact route for the line has yet to be determined. The proposed route for the line extends northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky, where it will interconnect with the existing local power grid. For this environmental impact statement (EIS), the transmission line is assumed to be constructed in a similar fashion to other 138-kV electric transmission lines built by EKPC in the project area. The line would require a 30 to 45 meter (100 to 150 foot) wide right-of-way. It is assumed that the majority of the transmission line route would extend through agricultural/rural portions of Clark and Montgomery Counties and not through highly populated residential areas. The transmission line is not expected to effect land use on surrounding areas or local land use plans or policies during construction or operation. As stated above, the Winchester-Clark County Planning Commission does not consider utility structures when determining zoning for an area. Therefore, the zoning for the area crossed by the proposed transmission line will remain the same.

5.2.4 Land Use Impacts from the Proposed Action

All land use impacts from No Action Alternative 2 would also occur under the Proposed Action. The gasification island would be constructed within the 4.8-hectare (12-acre) process area described in Section 5.2.3. In addition, supporting facilities would be built within the 121-hectare (300-acre) site, including a rail car unloading facility, a covered coal and refuse derived fuel (RDF) pellet storage facility, and a wastewater basin and would use a maximum of an additional 2.8 hectares (7 acres). This area has been

previously disturbed, therefore, impacts to land use would be minor. No effects on surrounding land uses are expected to occur from the construction and operation of the gasification island. It has not yet been determined by the Winchester-Clark County Planning Commission whether or not zoning would change within the J.K. Smith Site after the gasification island and supporting facilities are built.

5.3 Socioeconomics

Any sudden influx of capital or employment, such as a large construction project, to a region will impact the existing socioeconomic environment to some degree. Socioeconomic factors, such as employment, income, population, housing, and community services, are interrelated in their response to the implementation of an action. This section describes the potential effects of the Kentucky Pioneer IGCC Demonstration Project on the existing socioeconomic environment of the ROI of Clark, Fayette, and Madison Counties.

5.3.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are those changes that can be directly attributed to the Proposed Action, such as changes in employment and expenditures from the construction and operation of the proposed plant. Indirect impacts to the ROI occur based on the direct impacts from the Proposed Action. Two factors indirectly lead to changes in employment levels and income in other sectors throughout the ROI: (1) the changes in site purchase and non-payroll expenditures from the construction and operation phases of the plant, and (2) the changes in payroll spending by new employees. The total economic impact is the sum of the direct and indirect impacts.

The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by DOE in conjunction with KPE's contractors and representatives. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System multipliers developed specifically for the Kentucky Pioneer IGCC Demonstration Project ROI by the U.S. Bureau of Economic Analysis (BEA). These multipliers are developed from national input-output tables maintained by the BEA and adjusted to reflect regional trading patterns and industrial structure. The tables show the distribution of the inputs purchased and the outputs sold for each industry for every county in the United States. The multipliers for this analysis were developed from the input-output tables for the three counties comprising the ROI. The multipliers are applied to data on initial changes in employment levels and earnings associated with the proposed project to estimate the total (direct and indirect) impact of the project on regional earnings and employment levels. For this analysis, the term direct jobs refers to the employment created by the project, and direct income refers to project workers' salaries. The term indirect jobs refers to the jobs created in other employment sectors as an indirect result of new employment at the construction site, and indirect income refers to the income generated by the new indirect jobs.

The importance of the actions and their impacts is determined relative to the context of the affected environment, or project baseline, established in Section 4.3. The baseline conditions provide the framework for analyzing the importance of potential economic impacts that could result from the project. Impacts would be determined to be significant if the change resulting from the action analyzed would exceed historical fluctuations in the regional economy.

KPE provided estimates of construction and operation workforces and durations. The overall construction workforce would average 600 workers and reach a peak force of 1,000 for short periods of time. The socioeconomic impacts on employment and income are evaluated during the two phases of the project, construction and operation. The construction phase is analyzed for two different levels, average worker level and peak worker level, due to the large difference between the two figures. The employment generated by the operation of the plant is expected to remain constant at 120 employees for the duration of its in-service period of 20 years. The power island is estimated to cost 20 percent, or $82.8 million, of the overall $414 million project cost. Under No Action Alternative 2, only the power island would be constructed. Therefore, it has been assumed that 20 percent of all estimates provided for the Proposed Action would be required to construct and operate No Action Alternative 2.

Appraisal methods used to estimate land values are based on objective characteristics of the property and any improvements. The impact that the presence of a nearby aboveground facility may have on the value

of the land depends on many factors including size, existence of other facilities, the current value of the land, its location, current land use, and emotional response. A potential purchaser of a property would make a decision to purchase based on the planned use (such as agricultural, future subdivision, or home) of the property in question. For this analysis, impacts to property values are estimated based on the factors that may affect a potential purchaser of the land.

5.3.2 Socioeconomic Impacts from No Action Alternative 1

Under No Action Alternative 1, the proposed facility would not be built. No new employment or spending in the area would result and no direct or indirect affects would be attributable to the project. Therefore, employment and population in the ROI would remain the same as the baseline presented in Section 4.3 of this EIS and no socioeconomic impacts would be experienced.

5.3.3 Socioeconomic Impacts from No Action Alternative 2

5.3.3.1 Construction Phase

Under No Action Alternative 2, the two natural gas-fired General Electric (GE) 7FA combined cycle turbine units, the 27-kilometer (17-mile), 138-kV J.K. Smith to Spencer Road transmission line, and all associated support structures are assumed to be constructed at the site, which is located approximately 3.2 kilometers (2 miles) west of Trapp, Kentucky. Since the overall duration of the project construction is 30 months and only 20 percent of the resources are assumed to be devoted to the construction of the power island, the facility would take 6 months to build. The facility would employ 120 workers during the average construction period and 200 workers during peak periods. For the 6-month construction period, indirect employment would increase by 138 jobs during the average period and 230 jobs during peak periods. Though the ROI is comprised of Clark, Fayette, and Madison Counties, all facility construction and operation employment occurs in Clark County. The indirect employment created as a result is spread throughout the ROI. The average annual heavy construction salary, which includes industrial facility construction, for Clark County was $37,800 in 1998 (CBP 2000). Construction of the No Action Alternative 2 would result in between $2.3 and $3.8 million in direct new income and $2.2 and $3.5 million in indirect new income to the ROI for the 6-month construction period. The exact figures would depend on the duration of peak construction employment at the site. The comparatively minor number of construction jobs and indirect jobs would not present any significant socioeconomic impacts and unemployment, housing, and community service effects would not be expected.

5.3.3.2 Operations Phase

The power island facility would employ 20 percent, or 24 of the estimated 120 total operations phase employees required for the overall project. The 24 jobs directly generated by the operation of the facility would indirectly result in the creation of 54 other jobs in the ROI. These 78 jobs would be filled from the existing labor pool of the ROI. This should not result in any significant impacts as the number of direct and indirect jobs resulting from the operation of the facility is relatively small compared to the overall labor pool of the ROI. The unemployment rate would be slightly lower than the current 2.1 percent as a result, but the overall change in employment is insignificant and the statistic would remain at the 2.1 percent level. The average salary for utility employees in Clark County was $46,900 in 1998 (CBP 2000). This results in approximately $1.13 million in new direct income and $1.24 million in new indirect income annually for the established 20-year operational timeframe of the facility. The small number of jobs created by the operation of the facility is expected to have no impact on housing in the ROI as there is adequate housing available to accommodate any new residents. Community services in the ROI, including schools, hospitals, and fire services, should not experience any significant impacts from any population influxes as the jobs are expected to be filled from the existing labor pool. Should individuals move into the ROI for employment resulting from this project, existing community services should adequately meet the needs of the minor population influx.

As discussed in Section 5.5, Aesthetic and Scenic Resources, the facility would not be visible outside of the boundaries of the 1,263-hectare (3,120-acre) J.K. Smith Site. The presence of the facility may influence a potential purchaser of property located near the facility. The proposed facility would be located approximately 1.6 kilometers (1.0 mile) from the nearest tract available to a potential buyer, which is the nearest residence. The distance of the facility from nearby tracts of land should mitigate any potential effects on buyers and each potential purchaser has a different goal and ability to purchase land. Therefore, any impacts to property values would be negligible under No Action Alternative 2.

5.3.4 Socioeconomic Impacts from the Proposed Action

5.3.4.1 Construction Phase

Under the Proposed Action, the gasification technology facilities, two combined cycle units, fuel storage area, rail car loading and unloading areas, and all required associated support equipment would be constructed at the existing 540 megawatt (MW) natural gas-fired plant. The Proposed Action would cost $414 million and would take 30 months to construct. The project would employ an average construction work force of 600 people which could expand to 1,000 during periods of peak construction activity. The creation of 600 new jobs in Clark County and the associated new income would indirectly create 690 new jobs throughout the ROI for the 30-month construction period. The expansion of the construction work force to 1,000 employees during periods of peak construction would add an additional 460 jobs to the ROI. The Proposed Action would result in approximately $56.7 million in direct new income and $53.2 million in indirect new income for the 30-month construction period. These figures would increase depending upon the duration of peak construction activity. Each month that the construction phase would require peak work forces, an additional $1.3 million in direct income and $1.2 million in indirect income would be generated.

As stated previously, the unemployment rate for the ROI is 2.1 percent, which is relatively low. Most economists feel that a healthy unemployment rate is closer to 4 or 5 percent. The low unemployment rate places a strain on companies seeking to hire employees for a permanent or temporary basis, as workers are not available to take new positions. However, the unemployment rate should not be an issue with regards to the construction of the facility. Construction, by its very nature, employs workers on a temporary basis, therefore, once the structure is completed, the worker must find a new job. According to the County Business Patterns for the ROI, 10,828 people were employed in the construction industry within the ROI in 1998. Of these, 1,677 were employed in the category of heavy construction, which includes industrial and utility facility construction (CBP 2000). This establishes a labor pool within the ROI adequate to employ the 600 workers required during average construction periods.

Expansion to peak construction levels may put a strain on the local construction labor pool as it is somewhat optimistic to assume that nearly half of all construction workers in the ROI would be employed on the same project. Therefore, peak periods of construction may require an influx of labor into the ROI for brief periods of time. As established in Section 4.3, Socioeconomics, the housing characteristics of the ROI indicate that existing housing capacity should adequately accommodate a temporary influx of workers and no significant impacts would be felt. Workers entering the ROI on a temporary basis would most likely seek residence in a rental unit. The ROI has a 9.5 percent vacancy rate, or over 5,000 vacant units available for occupancy. Existing community services, including schools, hospitals, and fire and police services, would not be significantly affected since most of the construction workers would come from within the ROI and any influx would be of short duration.

The indirect employment created by the project would put more of a strain on local resources, as these jobs would be more difficult to fill from the existing labor pool of the ROI. During periods of average construction activity, 690 jobs would be indirectly created. This number would increase to 1,150 during peak periods of construction. Peak periods would be temporary by nature and, therefore, the larger number of indirect jobs created by peak work forces would also be on a temporary basis. The large majority of the indirect jobs created would be in the retail and services industries.

According to the unemployment figures presented in Section 4.3, Socioeconomics, a total of 4,229 individuals were unemployed in the ROI in 2000. This figure represents active job seekers in the labor pool who are not currently employed. This figure, however, does not capture the potential labor supply, which are individuals not currently seeking employment who would work should jobs become available. The Winchester Labor Market Area Statistics estimate that over 3,700 individuals fall into this category in the ROI. Another factor that would assist in mitigating the socioeconomic impacts of the creation of 2,150 total (1,000 direct and 1,150 indirect) jobs during periods of peak construction at the site is the future labor supply. This figure represents individuals who will become 18 years of age between 2001 and 2005. Assuming a constant rate over the 5-year period, 4,000 new individuals will be added to the labor supply each year in the ROI (WIA 1999).

The addition of new individuals to the labor supply in coming years and the large number of individuals in the potential labor supply category will help fill the jobs created both directly and indirectly by the construction of the facility. All individuals already living within the ROI who gain employment from this project will not impact the existing community services and housing levels as they are already included in the descriptions established in Section 4.3, Socioeconomics. It is likely, however, that individuals would come from outside the ROI to fill some of the newly created jobs. Any influx is expected to be relatively small in size and should have little to no impact on existing community services. Minor impacts may include an increase in classroom sizes in area schools and the need for additional police or fire service employees. Additional tax revenue generated by the project would be enough to employ additional staff at the Clark County Sheriff's Office. All of the fire services in the ROI utilize volunteer companies. Additional volunteers would be adequate to handle any additional strain on fire resources. As stated in Section 4.3, Socioeconomics, a new Clark County Fire Station is scheduled to be built near the J.K. Smith Site in the near future. Existing housing vacancy rates indicate that there is enough housing available in the ROI to accommodate any workers who move into the area.

The project location, 3.2 kilometers (2 miles) west of Trapp, Kentucky, is somewhat isolated. The population of Trapp is very small with approximately 100 people (Clark 2001). At periods of peak construction, ten times as many people would be employed onsite than live in the closest community. The size and location of the project site would not be sufficient to meet the needs (i.e., food) of the large number of people employed during the construction phase. Winchester, with a population of 15,800 (Clark 2001), is the closest town to the project site of sufficient size to supply the needs of workers at the site. A combination of the following two significant impacts would occur: (1) increased traffic on local roads to and from Winchester; and (2) an influx of businesses to the community of Trapp. This combination of impacts applies to the operations phase analyses of the Proposed Action and No Action Alternative 2 as well. The first impact is addressed in Section 5.11, Traffic and Transportation. An increase in businesses in Trapp would benefit the community by bringing extra income to the area. Employment generated by these businesses is a specific example of indirect jobs associated with the project and the effects of the new employment are included in the indirect impact analysis. The extent of the impact is directly related to the amount of employment at the project site. During periods of peak construction, there would be greater demand for services at the project site, and thus, more businesses would operate in Trapp and more jobs would be created in the restaurants. During the operations phase of the project, less people would be employed onsite and, thus, there would be less demand for food services near the site.

5.3.4.2 Operations Phase

The completed facility is scheduled to be in service for 20 years. The Proposed Action would employ 120 workers onsite in Clark County. This would result in the indirect creation of 270 jobs in the ROI. The creation of 120 jobs at the facility would create approximately $5.6 million and $6.2 million in direct and indirect new income annually, respectively. All direct and indirect jobs created by the operation of the facility would be filled from the labor pool in the ROI since all jobs associated with the construction phase of the project would cease to exist once construction has been completed and those previously employed individuals would be able to fill new jobs. All individuals who moved into the ROI to fill

employment opportunities during the construction phase would most likely move out of the ROI once construction has ended, leaving community services and housing at similar levels prior to their arrival. These are adequate to meet the needs of all individuals employed directly or indirectly by the operation of the facility. Construction workers would likely find employment on other construction projects. Unemployment would likely rise slightly in the ROI with the shrinking of job opportunities during the operations phase. This is not a serious concern, however, since it would not cause a rise above 4 percent, which is an acceptable level in a healthy economy.

As discussed in Section 5.5, Aesthetic and Scenic Resources, the facility would not be visible outside of the boundaries of the 1,263-hectare (3,120-acre) J.K. Smith Site. Since the presence of an aboveground facility disrupts the visual aesthetics, a potential purchaser may decide not to purchase the property. However, each potential purchaser has a different goal and ability to purchase land. The presence of the facility may influence a potential purchaser of property located near the facility. The proposed facility would be located approximately 1.6 kilometers (1.0 miles) from the nearest tract available to a potential buyer, which is the nearest residence. The distance of the facility from nearby tracts of land should mitigate effects on potential buyers. Under the Proposed Action, the disruption to the viewshed caused by the gasifier stacks may result in negative impacts to property values for areas near the facility; however, there is no established method for determining the exact quantitative impacts to property values from an action because the value is based on numerous factors.

5.4 Cultural Resources

This section discusses the potential impacts of the Kentucky Pioneer IGCC Demonstration Project on cultural resources, archaeological and historic sites, and areas of cultural or religious importance to communities or ethnic groups on or surrounding the proposed project site.

5.4.1 Methodology

Potential impacts to cultural resources, in general, are assessed by applying the criteria of adverse effect as defined in 36 *Code of Federal Regulations* (CFR) 800.5[a]. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion on the National Register of Historic Places (NRHP) in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Some examples of adverse effects to cultural resources include: physical destruction or damage; alterations not consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*; relocation of a property; isolation and restriction of access; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect resulting in deterioration; or transfer, lease or sale of historic properties without adequate protections. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be further removed in distance, or be cumulative. Activities conducted under the alternatives are measured against the criteria of adverse effect to determine the potential for and intensity of impacts to cultural resources. The assessment of impacts to traditional cultural properties and practices also requires a focused consultation effort with the affected community.

While the lead federal agency makes the determination of adverse effect, consultation with the State Historic Preservation Officer (SHPO), in this case the Kentucky Heritage Council (KHC) and other parties, is required regarding the application of the criteria of adverse effect and in developing mitigation efforts to avoid or reduce any impacts. Consultation with the KHC has occurred for this undertaking through a letter requesting participation and assistance in completion of the Section 106 Review process as described in Section 4.4, Cultural Resources. The assistance of the KHC was also requested to identify individuals, organizations, local governments or Native American groups who may wish to be consulting parties on this undertaking and to identify potential information sources. The Kentucky SHPO determined that the Section 106 Review process was completed for this project's Area of Potential Effect in December of 1980. The terms of the Memorandum of Agreement drawn up in conjunction with the Advisory Council on Historic Preservation for the J. K. Smith Power Station have been met under the Kentucky Pioneer IGCC Demonstration Project and further identification, evaluation, mitigation, and consultation activities are no longer required.

5.4.2 Cultural Resource Impacts from No Action Alternative 1

No impacts to cultural resources would be expected under No Action Alternative 1.

5.4.3 Cultural Resource Impacts from No Action Alternative 2

As described in Section 4.4, the cultural resources of the 121-hectare (300-acre) project area were identified, evaluated for NRHP-eligibility, and data recovery mitigation measures were implemented in conjunction with the J.K. Smith Power Station undertaking. The Section 106 Review process was completed according to the standards and guidelines in place at that time. Subsequent grading and other site development activities for the aborted J.K. Smith project have decreased the potential for the existence or discovery of intact prehistoric or historic resources that would meet NRHP-eligibility requirements. Likewise, previous site disturbances have decreased the likelihood of any intact Native American or other traditional use areas or religious sites, although notification and exploration of this issue with potential consulting parties has not been completed. In accordance with 36 CFR 800.4(d) of the Advisory Council on

Historic Preservation's revised regulations, the Kentucky SHPO has determined that there is no effect on historic properties.

The precise location of utility and transmission line corridors, and any additional disturbance areas such as borrow pits and construction laydown areas have not been defined. As part of the Section 106 Review process for the transmission line, potential impacts to historic properties in these areas must be addressed. Determination of the potential for visible, audible and atmospheric alterations to the setting of off-site cultural resources would be required in consultation with the KHC. If resources are encountered during construction, discovery procedures discussed in Section 5.18.1, Cultural Resources, would be implemented.

5.4.4 Cultural Resource Impacts from the Proposed Action

The Proposed Action is a federal undertaking subject to the Section 106 regulations found at 36 CFR 800. It involves an activity "requiring a federal permit, license or approval" which may have an effect on historic properties (36CFR 800.16[y]).

As described in Section 4.4, the cultural resources of the 121-hectare (300-acre) project area were identified, evaluated for NRHP-eligibility, and data recovery mitigation measures were implemented in conjunction with the J.K. Smith Power Station undertaking. The additional 2.8-hectare (7-acre) area required under the Proposed Action for the construction of the rail car loading and unloading and storage facilities is also located within the 121-hectare (300-acre) project area. The Section 106 Review process was completed according to the standards and guidelines in place at that time. Subsequent grading and other site development activities for the aborted J.K. Smith project have decreased the potential for the existence or discovery of intact prehistoric or historic resources that would meet NRHP-eligibility requirements. Likewise, previous site disturbances have decreased the likelihood of any intact Native American or other traditional use areas or religious sites, although notification and exploration of this issue with potential consulting parties has not been completed. In accordance with 36 CFR 800.4(d) of the Advisory Council on Historic Preservation's revised regulations, the Kentucky SHPO has determined that there is no effect on historic properties.

As part of the Section 106 Review process for the transmission line, potential impacts to historic properties in these areas must be addressed. Determination of the potential for visible, audible and atmospheric alterations to the setting of off-site cultural resources would be required in consultation with the KHC. If resources are encountered during construction, discovery procedures discussed in Section 5.18.1 would be implemented.

5.5 Aesthetic and Scenic Resources

This section discusses the potential effects of the construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility on aesthetic and scenic resources at the project site and surrounding areas.

5.5.1 Methodology

Potential impacts to aesthetic and scenic resources include the construction of new structures and/or modifications to existing structures and the potential contribution of air pollutants that may alter the view or quality of these resources. The impact analyses for the Proposed Action considered the effects of construction and operation of the Kentucky Pioneer IGCC Demonstration Project on those lands in which the plant is visible. The impact analyses also consider an ROI that assumes a proposed route for a 138-kV transmission line that extends northeasterly from the project site to the Spencer Road Terminal in Montgomery County, Kentucky.

5.5.2 Aesthetic and Scenic Resource Impacts from No Action Alternative 1

Under No Action Alternative 1, DOE would not provide partial funding for the design, construction, and operation of the proposed project. Because no new construction would occur, there would be no impacts to aesthetic or scenic resources.

5.5.3 Aesthetic and Scenic Resource Impacts from No Action Alternative 2

The proposed combined cycle units would not have any significant impacts on aesthetic and scenic resources. Since the combined cycle units would be built within the J.K. Smith Site, the units would not be visible from outside the site area. The units would most likely not be visible from the high observation position of the top of Pilot Knob State Nature Preserve located 12.8 kilometers (8 miles) east of the project site. The facility will have lighting as required for safety purposes to illuminate stairways and entrances. Lighting will be needed for downward illumination, thus impacts from night lighting should be minimal. In addition, there would be no visible plumes associated with the combined cycle units. The proposed natural gas-fired combined-cycle units also would not have any significant impacts on the aesthetic and scenic resources of the Daniel Boone National Forest or the Red River.

Construction of the combined cycle units would produce dust that may affect visibility temporarily in the local construction areas within the J.K. Smith Site. Dust control measures would be implemented to minimize impacts.

The proposed new transmission line would be approximately 27 kilometers (17 miles) in length; however, the exact route for the line has yet to be determined. For this EIS, the transmission line is assumed to be constructed in a similar fashion to other 138-kV electric transmission lines built by EKPC in the project area. The line would require a 30 to 45 meter (100 to 150 foot) wide right-of-way. The electrical conductors would be supported by double wood and/or steel, single and/or double pole structures. The average height of the support structures would be approximately 24 meters (80 feet) aboveground and the average span between structures would be 122 to 305 meters (400 to 1,000 feet), depending upon the terrain. It is assumed that the majority of the transmission line route would extend through agricultural/rural portions of Clark and Montgomery Counties and not through highly populated or residential areas. The most significant impacts to the general public and residences in the area, if any, would be disturbance during construction, such as increased noise and dust. In addition, the proposed transmission line would introduce new elements which would alter the existing landscape. Long-term impacts to the visual quality of the landscape would be the introduction of pole structures. The impacts from the introduction of the pole structures could be significant when viewed from sensitive viewpoints. It is assumed that the transmission line would not be visible to the public except in areas where the proposed route crosses roads or highway systems.

5.5.4 Aesthetic and Scenic Resource Impacts from the Proposed Action

Aesthetic and scenic resource impacts from the construction of the power island and transmission line would be the same as those detailed in the No Action Alternative 2 analysis.

The proposed new facility stacks associated with the gasification island would be approximately 65 meters (213 feet) tall. The upper portions of the stacks would likely be visible from the city of Winchester located 13.4 kilometers (8.3 miles) from the site. In addition, the facility structures would be visible from the 222.5-meter (730-foot) high observation position on top of Pilot Knob State Nature Preserve located 12.8 kilometers (8 miles) east of the project site. The facility would also be visible from the community of Trapp located approximately 3.2 kilometers (2 miles) east of the project site. The facility stacks will have a strobe light to meet the Federal Aviation Administration lighting requirements. The facility will also have lighting as required for safety purposes to illuminate stairways and entrances. Lighting will be hooded for downward illumination, thus impacts from night lighting should be minimal. In addition, the proposed gasification island would not have any significant impacts on the aesthetic and scenic resources at the Daniel Boone National Forest or at the Red River.

There would be visible plumes associated with the cooling towers. The visibility of the plumes would be dependent upon the weather and wind patterns, and the location of the viewer within the general topography of the area. The plumes would most likely be visible from the community of Trapp, the Pilot Knob State Nature Preserve, and up to 12.8 kilometers (8 miles) from the J.K. Smith Site.

In the event of an uncontrollable pressure buildup within the gasification system, the synthesis gas (syngas) would be routed to an emergency flare. The emergency flare would release the pressure on the system by burning the excess syngas. Facility design has yet to be completed and the location of the emergency flare vent has not been indicated. For this analysis, the worst-case scenario would be to locate the flare vent at or near the top of the 65 meter (213 feet) tall gasification facility stacks. During an emergency flare release, the flare would be visible from the same distances as the facility stacks, as described earlier in this section. The emergency flare would be an infrequent event of short duration and, as such, would not have a lasting effect on the aesthetics and scenic resources of the project site area. It is possible for emergency flares to occur at night, resulting in brief periods of additional lighting near the facility. The short duration of these events, however, should not have any significant impact to local residents other than brief periods of minor illumination.

Construction of the gasification island would produce dust that may affect visibility temporarily in the local construction areas. Dust control measures would be implemented to minimize impacts.

5.6 Geology

This section discusses the potential effects of the construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility on geology at the project site and surrounding areas.

5.6.1 Methodology

The geology and soils analysis considers a region of influence which includes the Kentucky Pioneer IGCC Demonstration Facility project area, as well as the entire J.K. Smith Site. Impacts to these resource areas were determined by assessing potential changes in existing geology and soils that could result from construction activities and operations under the Proposed Action. In addition, potential impacts from geologic hazards are evaluated.

5.6.2 Geology Impacts from No Action Alternative 1

Under No Action Alternative 1, DOE would not provide partial funding for the design, construction, and operation of the proposed project, and the project would not be built. Because no new construction would occur, there would be no impacts to geologic or soils resources from project activities. However, because the site has already been disturbed, any erosion that may be occurring would continue.

5.6.3 Geology Impacts from No Action Alternative 2

Because the site was previously disturbed during site preparation by EKPC in the 1980s, the construction of the Kentucky Pioneer IGCC Demonstration Project would have limited impact on geological resources. Most prime farmland soils have already been disturbed and there are no mineral resources on the project site.

Hazards posed by geological conditions are expected to be minor. Based on the available data, it is unlikely that karst terrain is present at the project site. Several factors support this theory:

- The site-specific boring logs do not indicate karst development.
- The geologic formations found beneath the project site are generally described as not having karst features.
- The project site is not in a “highly developed” or “intense karst” area.
- There are non-karst areas in the vicinity of the project site.

The major part of east-central Kentucky, including the project site, is in a region of limited earthquake activity. Very strong earthquakes that have occurred in the New Madrid seismic zone, located approximately 482 kilometers (300 miles) west-southwest of the project site, have caused minor damage in east-central Kentucky. Furthermore, no known capable faults, as defined under 10 CFR 100, exist in the project vicinity. The faults closest to the project site have had no movement in historic time. Ground rupture as a result of an earthquake is unlikely. It is thus unlikely that the site would be affected by seismic activity.

Soil disturbance caused by building material laydown would be minimal because the soil has been previously graded. Properties and conditions of soils underlying the proposed site have no construction limitations. Soil disturbance from new construction would occur at construction laydown areas, destroying soil profile, and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Standard erosion control methods would limit soil loss and transport of eroded soil.

The soil types at the proposed site are considered prime farmland soils; however, the disturbed portions of the site are no longer considered prime farmland. Thus, new construction associated with implementing No Action Alternative 2 would cause a slight increase in loss of prime farmland.

There is potential for soil contamination from fuel or other hazardous material spills, primarily during construction, but also during operation. The shallow depth to bedrock (approximately 1.5 meters [5 feet]), however, would limit the potential for contaminant migration.

5.6.4 Geology Impacts from the Proposed Action

Geologic impacts for the Proposed Action would be the same as those detailed in the No Action Alternative 2 analysis. Additional construction including foundation laying would be required for the storage facilities and railcar loading and unloading sites. The design of these facilities will not be completed until project funding is finalized. The construction of these facilities would result in additional disturbances to small areas of prime farmland soils, though the exact acreage disturbed cannot be given until the design of the facility is completed. The impacts to geologic resources from the Proposed Action would be slightly greater than those described above for No Action Alternative 2, though the exact difference is dependant upon the size of the associated facility structures required to support the operation of the gasification island. Other potential soil contaminant sources during operation are coal and other feed material storage piles, if stored on bare ground and left exposed to rainfall. The facility will be designed to store and convey such material in totally enclosed structures, thus eliminating the potential for migration to soil or groundwater. The potential impacts to the project from geologic hazards would be the same under the Proposed Action as under No Action Alternative 2.

5.7 Air Resources

The air resources in the region of the Kentucky Pioneer IGCC Demonstration Project could be affected by air pollutant emissions associated with construction and operation activities. This section describes the assessment methodology and potential effects of construction and operation of the proposed project on local and regional air quality.

5.7.1 Methodology

Air quality impacts have been evaluated in terms of anticipated emissions from proposed facilities and resulting changes to ambient air quality in the project vicinity. Data used for the impact assessment come primarily from the environmental information volume (EIV) (EIV 2000), and were based in turn on the Prevention of Significant Deterioration (PSD) Permit Application for the proposed facility. The PSD/Title V Permit Application and the Final PSD/Title V Permit for the facility have been used as additional sources of information.

The PSD/Title V Permit Application (Radian 1999) contained emission estimates for various components of the facility plus a dispersion modeling analysis that identified maximum incremental ambient air quality impacts. Dispersion modeling analyses followed normal procedures: preparation of a modeling protocol agreed to by regulatory agencies; modeling analyses using the Industrial Source Complex model; and use of 5 years of representative meteorological data to identify maximum ambient air quality impacts. Impact significance has been evaluated by comparing modeled ambient air quality increments to thresholds in applicable PSD regulations and National Ambient Air Quality Standards (NAAQS).

The Final PSD/Title V Permit for the Kentucky Pioneer IGCC Demonstration Project facility (permit number V-00-049) has been issued pursuant to state regulations (401 Kentucky Administrative Regulations [KAR] Parts 50, 51, 59, 60, and 63) that incorporate federal *Clean Air Act* (CAA) requirements, including those for PSD, standards of performance for stationary gas turbines (40 CFR 60 Subpart GG), and standards of performance for large municipal waste combustors (40 CFR 60 Subpart Eb).

The Final PSD/Title V Permit requires that the combustion turbines (CTs) use only SYNTHESIS GAS (syngas) or natural gas as fuels, and that the rated heat input capacity of the turbines not exceed 1,765 million British Thermal Units per hour at International Organization for Standardization standard day conditions (197 MW power output capacity for each turbine, not including heat recovery steam generator capacity).

The Final PSD/Title V Permit Application was for a 400-MW facility run on syngas generated from fuel briquettes. The direct generation capacity of the two GE 7FA gas turbines used under No Action Alternative 2 and the Proposed Action without the heat recovery generators is 400 MW. The additional electricity generated by the heat recovery generators increases the total facility output to 580 MW. Because the heat recovery generators have no emissions, their capacity output is not included in the permit analysis. The Final PSD/Title V Permit specifically references two GE 7FA gas turbine units with a direct output capacity of 197 MW each. The fuel briquettes were to be produced from a mixture of coal and municipal solid waste (MSW), or from a mixture of coal and sewage sludge. When MSW is used for briquette production, it is first sorted to remove glass and metal items, and is then shredded. The briquette is comprised of 50 percent coal and 50 percent refined MSW. Thus, the briquettes would be similar to a co-feed of RDF pellets and coal. Amendments to the Final PSD/Title V Permit may be required to account for the change in material handling from fuel briquettes to RDF pellets and coal. It is, however, unlikely that such amendments would result in substantive changes to the emission limits contained in the Final PSD/Title V Permit since the permit application material indicates that emission estimates were based on guarantees of stack gas outlet concentrations and estimated stack gas flow volumes that are unlikely to change. The PSD/Title V Permit was formally issued in early June 2001 and Global Energy, Inc., does not intend to seek a modification to the permit until facility design plans are more complete and all relevant modifications can be addressed at one time.

5.7.2 Air Resource Impacts From No Action Alternative 1

No Action Alternative 1 would leave the project site in its existing condition. No energy production facilities would be constructed at the J.K. Smith Site, and no off-site alternative facilities would be constructed. Consequently, there would be no air quality impacts from No Action Alternative 1.

5.7.3 Air Resource Impacts From No Action Alternative 2

No Action Alternative 2 would result in no DOE funding for the Kentucky Pioneer IGCC Demonstration Project, but KPE would build a natural gas-fueled combined-cycle plant at the site. Construction activities would be similar to those required for the proposed project, and the construction period would be about 6 months. The power island also would require construction of a 27-kilometer (17-mile) 138-kV transmission line connecting the site to the local power grid.

Operational air quality impacts under No Action Alternative 2 would be similar in general magnitude to those discussed for the Proposed Action, since the CTs would be the dominant emission sources in either case. Based on U.S. Environmental Protection Agency (EPA) emission rate data (EPA 2000), using natural gas to fuel the CTs would result in 45 percent lower ROG emissions, 81 percent higher NO_x emissions, 6 percent lower CO emissions, 89 percent lower SO_x emissions, and 40 percent lower PM_{10} emissions than would occur under the Proposed Action. Greenhouse gas emissions would be about 25 percent higher under No Action Alternative 2 than under the Proposed Action, since natural gas has a higher carbon content than syngas. No Action Alternative 2 would not have additional emission sources such as the flare for the gasifier facility, fuel unloading and handling equipment, or sulfur recovery equipment.

The workforce required for facility operation would be somewhat smaller than the work force required for the Proposed Action. The workforce has been estimated at 20 percent of overall project operations workforce, or 24 workers. Resulting traffic volumes would be approximately 20 vehicles at any shift change period. This small increment of additional traffic would not have a significant impact on traffic-related air quality conditions in the area.

5.7.4 Air Resource Impacts From the Proposed Action

Construction of the proposed facility would have vehicle, equipment, and fugitive dust impacts similar to any construction project of comparable size. Because the site was previously graded and had some foundation work performed for the J.K. Smith Power Station, there would be less earthmoving activity than would be required for other sites in similar terrain. Construction-related traffic, construction equipment, and fugitive dust from the construction site would be the major emission sources associated with construction activity.

The Kentucky Pioneer IGCC Demonstration Project facility would have several components that would be sources of air pollutant emissions:

- raw material storage and handling
- emergency flare associated with the gasification plant
- cooling tower facility
- vitrified frit handling facilities
- sulfur recovery and handling facilities
- wastewater treatment facilities
- CTs associated with power generation facilities

The air separation plant would have few if any emissions. The Draft PSD/Title V Permit does not set any emission limits for air separation plant or the wastewater treatment facility. The Draft PSD/Title V

Permit does set emission limits or operational requirements for other facility components. Emission controls incorporated into facility designs include:

- enclosed storage of raw materials
- fabric filters on petroleum coke and limestone storage silos
- covered conveyors for raw material transfers
- drift eliminator on the cooling tower
- steam injection or other combustion controls to reduce nitrogen oxide (NO_x) emissions from gas turbines

The Final PSD/Title V Permit for the proposed project requires KPE to conduct a new analysis of Best Available Control Technology for NO_x emissions after facility startup. That analysis must be provided to the Kentucky Division for Air Quality no later than 24 months after facility startup. The Kentucky Division of Air Quality will then determine whether or not to modify the NO_x emission limits and NO_x control equipment requirements for the facility.

Compliance with emission limits set by the Final PSD/Title V Permit will be verified by a detailed set of monitoring and reporting requirements as outlined in the permit. Continuous emission monitoring equipment is required on the generator system stacks for NO_x, CO, O_2, SO_2, and opacity. Initial stack tests are required for NO_x, CO, SO_2, PM_{10}, volatile organic compounds, beryllium, cadmium, lead, mercury, hydrogen chloride, and dioxins/furans. In addition, annual stack tests are required for PM_{10}, cadmium, lead, mercury, hydrogen chloride, and dioxins/furans. Initial monitoring of H_2S is required at the sulfur recovery facility, and periodic opacity observations are required at various material handling facilities.

Raw materials for the gasification plant include RDF fuel pellets, coal, petroleum coke, and limestone. Raw materials would arrive by rail and be stored in buildings or storage silos. Petroleum coke would be used only for cold startup of the gasifier. Once started, the primary fuel would be RDF pellets and coal. Limestone would be added to the fuel feed to serve as a fluxing agent. All feedstocks to the gasifier plant would be transferred from storage facilities using covered conveyors to minimize particulate matter emissions.

The gasification plant would have four fixed-bed, oxygen-blown slagging gasifiers. The gasifiers use a pressurized high temperature, low oxygen environment to decompose fuel into a mixture of gaseous components and a molten ash slag. The low oxygen conditions result in a syngas fuel that is primarily carbon monoxide (CO) and hydrogen, but contains small amounts of other components. The molten slag would be cooled and solidified into an inert, vitrified frit that can be used as a synthetic aggregate. The gasification plant would have an emergency flare system to avoid venting raw syngas in the event of process interruptions or unplanned shutdowns.

The syngas produced by the gasifiers would be cooled in a heat exchanger facility to produce process steam. The cooling would condense light oils and water from the syngas. The condensation process also would remove particulate matter suspended in the syngas. The light oils would be reinjected into the gasifiers. A cooling tower unit would be associated with the heat exchanger facility.

The cooled syngas would then undergo an acid-gas cleanup to remove sulfur compounds and other trace contaminants. One of several commercially proven solvent absorption processes will be selected for the acid-gas cleanup. All of the clean-up processes can provide 99 percent sulfur removal from the syngas. The amine-type solvents used in the process would be recovered and recycled. A prewash extraction product containing various organic components would be reinjected into the gasifiers. The solvent stream containing the removed sulfur would be sent to a Claus sulfur plant for sulfur recovery. Tail gas from the Claus facility would be recycled to the gas cleanup unit, thus avoiding emissions of oxides of sulfur (SO_x).

An air separation plant at the site would produce oxygen and nitrogen for on-site needs. Some of the oxygen would be used in the gasifiers. Oxygen and nitrogen would be blended into the cleaned syngas to dilute it to its desired heating value. The air separation plant would use cryogenic or pressure swing processes to separate oxygen and nitrogen from atmospheric air. Electrical power for the air separation plant would come from the power generation system. Because the only input to the air separation plant is atmospheric air, the gas flow released back to the atmosphere is not considered an emission source under air quality regulations.

The primary power production facilities at the site would be generators powered by two syngas-fueled gas turbines. Each gas turbine would be coupled to a heat recovery steam generator system for further power generation. The gas turbines can run on natural gas (as under No Action Alternative 2) if the syngas fuel supply is interrupted. Combustion exhaust from each gas turbine would pass to a heat recovery steam generator system to power an additional generator. Exhaust gases from each heat recovery steam generator would be released through an exhaust stack. For emissions analysis purposes, the PSD permit application assumed that all syngas would be used in the gas turbines.

The major stationary sources of emissions at the proposed facility would be the generator systems and cooling tower. Dissolved and suspended solids in the water sprayed through the cooling tower would be a source of inhalable particulate matter (PM_{10}) emissions as mist droplets released from the cooling tower evaporate to dryness. Small quantities of combustion exhaust would result from use or testing of the emergency flare. Fugitive PM_{10} emissions would come from material handling (RDF pellets, coal, petroleum coke, and limestone). A small amount of PM_{10} would be released through roof vents at the gasifier building. Wastewater treatment facilities would release small quantities of volatile organic compounds. Table 5.7-1 summarizes the annual emission estimates for the Kentucky Pioneer IGCC Demonstration Project facility based on the PSD/Title V Permit Application. These emission estimates are also representative of the proposed project's use of RDF and coal to generate the syngas.

Table 5.7-1. Emission Estimates for the Kentucky Pioneer IGCC Demonstration Project Facility

	Annual Emissions, Tons per Year				
Emission Source	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**
Material Handling in:					
Fuel Storage Building					0.58
Limestone Silo Loading					0.01
Limestone Silo Unloading					0.13
Gasifier Building vents					0.57
Emergency Flare	0.10	0.04	0.26		
Vitrified Frit handling					0.35
Cooling Tower					26.28
Generator System stack 1	34.02	556.61	247.38	247.38	85.04
Generator System stack 2	34.02	556.61	247.38	247.38	85.04
Wastewater Treatment	1.90				
TOTALS	70.04	1,113.26	495.02	494.76	198.00

Source: EIV 2000; KDAQ 2001.
Note: Emission estimates for the generator system units are based on emission limits in the Final PSD/Title V Permit, assuming 100 percent syngas fuel.

The Final PSD/Title V Permit shows that SO_x emission allowances are needed, but indicates that there are no nitrogen oxide requirements for the Phase II Acid Rain Permit. Global Energy, Inc., would obtain the SO_x allowances through standard industry practices, such as purchasing them on the open market.

Although sulfur recovery from the syngas fuel system would remove more than 99 percent of the sulfur content of the coal and RDF pellets, the cleaned syngas fuel would still have a sulfur content much higher than that of natural gas. Sulfur emission from use of syngas fuel in the CTs would be similar to the sulfur emissions that would result if the turbines were run on distillate fuel oil. These emissions, however, would be much lower than those from a comparable coal-fired power plant. Because the proposed project

does not have any sulfur emission allowances under the CAA, KPE must obtain existing sulfur emission allowances from another source before the proposed project is allowed to operate.

The potential for acid deposition impacts has been evaluated by assuming that all of the sulfur compounds emitted by the proposed project would be converted into sulfuric acid and subsequently deposited downwind of the project site. For screening analysis purposes, the following very conservative assumptions were made: that wind direction would blow continuously into a single 45 degree compass sector for the entire years and that all sulfur compound emissions would be converted into sulfuric acid and deposited within 96 kilometers (60 miles) of the project site. Since the annual average wind speed for the Lexington region is 14.6 kilometers per hour (9.1 miles per hour) (NCDC 2001), this represents less than 7 hours of transport time as an annual average. Full transformation and deposition of sulfur emissions normally occurs over a period of days rather than a few hours. A 45 degree compass sector extending 96 kilometers (60 miles) from the project site would encompass about 366,244 hectares (905,000 acres). The resulting sulfur deposition rate would be an average of 1.9 kilograms of sulfuric acid per hectare (1.7 pounds per acre) per year. If this were dissolved in the annual average precipitation (113.16 centimeters [44.55 inches] per year), the resulting rainfall would have a pH increment of 5.47 attributable to the project's sulfur emissions. This is only slightly more acidic than the pH of precipitation through clean air in balance with existing atmospheric carbon dioxide concentrations. Even under conservative assumptions, the proposed project would not have any significant impact on acid deposition patterns in areas downwind from the facility. In actuality, the sulfur emissions from the project would be distributed over a much larger area than this, and consequently the project would have even less of an incremental impact on acid deposition.

Greenhouse gas emissions from the proposed project have not been evaluated in the EIV or PSD Permit Application. The primary greenhouse gas that would be emitted by the proposed project is carbon dioxide (CO_2) along with smaller amounts of hydrocarbons. The use of any fossil fuel (i.e., coal, natural gas, petroleum) or other fuel containing carbon (i.e., RDF) to produce power contributes to greenhouse gases. The EPA emission rate estimates for large gas turbine generators fueled by natural gas indicate an emission rate of 546 grams (1.2 pounds) of CO_2 per kilowatt-hour of production output. Under No Action Alternative 2, CO_2 production from the two 197 MW gas turbines would be a maximum of 1.8 million metric tons (2.1 million tons) per year or 5,160 metric tons (5,690 tons) per day.

Since natural gas is composed primarily of methane, ethane, propane, and butane, it has a higher relative carbon content than syngas which is composed primarily of CO, hydrogen, and CO_2. The syngas would be diluted with nitrogen gas to reduce its heat content to the range appropriate for the gas turbines, thus further reducing the carbon concentration of the fuel gas with respect to natural gas. Therefore, it is unlikely that the carbon content of the syngas burned in the CTs under the Proposed Action would exceed the carbon content of natural gas burned under No Action Alternative 2. As a conservative estimate, the carbon content of syngas is estimated to be about 75 percent of the value for natural gas. Assuming an emission rate of 410 grams (0.9 pounds) of CO_2 per kilowatt-hour of production output, the proposed project would produce a maximum of 1.4 million metric tons (1.6 million tons) per year of CO_2 or 3,870 metric tons (4,270 tons) per day.

The CTs and sulfur handling facilities would be sources of small quantities of various hazardous air pollutants. Estimated annual emissions of hazardous air pollutants based on the use of fuel briquettes in the PSD/Title V Permit Application are identified in Table 5.7-2.

Table 5.7-2. Hazardous Air Pollutant Emissions for the Kentucky Pioneer IGCC Demonstration Project Facility

		Estimated Emissions	
Pollutant	**Emissions Sources**	**Pounds/Hour**	**Tons/Year**
Arsenic	Gas Turbines	0.020	0.088
Benzene	Gas Turbines	0.30	1.30
Beryllium	Gas Turbines	0.0020	0.0088
Cadmium	Gas Turbines	0.02	0.07
Carbon Disulfide	Gas Turbines	0.0002	0.001
Carbonyl Sulfide	Gas Turbines	0.03	0.14
Chromium	Gas Turbines	0.0037	0.016
Cobalt	Gas Turbines	0.04	0.18
Formaldehyde	Gas Turbines	0.52	2.27
Hydrogen Sulfide	Gas Turbines and Sulfur Storage/Loading	0.043	0.19
Lead	Gas Turbines	0.03	0.15
Manganese	Gas Turbines	0.013	0.059
Mercury	Gas Turbines	0.002	0.010
Nickel	Gas Turbines	1.042	4.562
Selenium	Gas Turbines	0.005	0.021
Total HAPS Emissions		2.07	9.07

Source: Radian 1999.

Hazardous air pollutant emissions from syngas generated directly from RDF pellets and coal would be virtually identical to these estimates. Radionuclide emissions from the proposed project have not been evaluated in the EIV or PSD Permit Application. Small quantities of radionuclides which naturally occur in fossil fuels may be emitted. Such emissions are expected to be minor and below regulatory thresholds.

The potential for long-term heavy metal deposition impacts has been evaluated by assuming that all of the metal compounds emitted by the proposed project would be incorporated into PM_{10} emissions and deposited downwind of the project site. For screening analysis purposes, the following conservative assumptions were made: that wind directions would blow continuously into a single 45 degree compass sector for 20 years, and that all metal compound emissions would be deposited within 56 kilometers (35 miles) of the project site. Since the annual average wind speed for the Lexington region is 14.6 kilometers per hour (9.1 miles per hour) (NCDC 2001), this represents less than 4 hours of transport time as an annual average. A 45 degree compass sector extending 56 kilometers (35 miles) from the project site encompasses about 124,645 hectares (308,000 acres). Metal compound emissions from the proposed project (as summarized in Table 5.7-2) are estimated at 4.68 metric tons (5.16 tons) per year (93.6 metric tons [103.2 tons] over 20 years). The resulting heavy metal deposition rate would be an average of 0.0375 kilograms per hectare (0.0335 pounds per acre) per year, or 37.5 grams per hectare (0.54 ounces per acre) per year. Over a total of 20 years, the cumulative deposition of heavy metals would total an average of 0.75 kilograms per hectare (0.67 pounds per acre), or 756.6 grams per hectare (10.7 ounces per acre). That quantity does not indicate any potential for significant impacts from heavy metal deposition downwind of the proposed project.

RDF pellets are generally stable, and undergo little or no decomposition during storage. Consequently, no odor problems are anticipated from the transport, storage, or handling of this fuel. Organic compound emissions from the wastewater treatment facility and hydrogen sulfide (H_2S) emissions from the sulfur handling facilities are too small to cause any off-site odor problems.

In addition to the stationary sources noted above, there would be mobile source emissions from employee traffic, service vehicles, and locomotives bringing raw materials to the site. Rail traffic to and from the site would amount to four trains per week. With a total workforce of 120 required for the Proposed Action to support 24-hour operations, commute traffic volumes would be less than 80 vehicles at any shift change period. Highway and rail traffic volumes to and from the site are clearly too low to cause significant ambient air quality impacts.

Dispersion modeling analyses were performed as part of the PSD Permit Application for the proposed project to evaluate the extent to which stationary sources associated with the proposed project might alter ambient air quality conditions. The dispersion modeling analysis followed standard procedures used for PSD permit applications, and covered areas within about 12 kilometers (7.5 miles) of the site. Modeling results are summarized in Table 5.7-3. As indicated in Table 5.7-3, the highest modeled pollutant concentrations are well below the values for the corresponding NAAQS. The highest modeled pollutant concentrations are also below the thresholds set in the EPA PSD regulations to identify incremental air quality impacts that may require further evaluation.

The dispersion modeling results summarized in Table 5.7-3 have been used to extrapolate maximum annual average downwind concentrations for hazardous air pollutants. Those maximum annual average concentrations allow an approximate estimate of cancer risk for several of the hazardous compounds. Table 5.7-4 summarizes the lifetime exposure cancer risk that would be associated with the location of maximum downwind concentrations. The cancer risk values in Table 5.7-4 assume continuous exposure for 70 years. Exposure for a shorter cumulative period would have proportionately lower cancer risks.

Most of the compounds listed in Table 5.7-4 (all except benzene, carbon disulfide, carbonyl sulfide, formaldehyde, and hydrogen sulfide) would be associated only with PM_{10} emissions. Benzene and carbon disulfide would be present in both gas and aerosol phases. Carbonyl sulfide, formaldehyde, and hydrogen sulfide would be present as gases. Dispersion modeling conducted for the PSD/Title V Permit Application indicates that the location of maximum 24-hour average and maximum annual average PM_{10} concentrations would be within 0.8 kilometers (0.5 miles) of the facility, within the boundaries of the J.K. Smith Site property. PM_{10} concentrations beyond the boundaries of the J.K. Smith Site property would be less than the maximum values. The area of maximum annual average concentration for gaseous emissions would be about 9.1 kilometers (5.7 miles) downwind of the facility.

The modeling analysis prepared for the PSD application also considered potential air quality impacts at Mammoth Cave National Park, about 185 kilometers (115 miles) from the proposed project. That analysis found no significant visibility or ambient air quality impacts to the park (EIV 2000).

As noted in Section 4.7, Air Resources, Clark County is designated as an unclassified area for all criteria pollutants. Because Clark County is in attainment of federal air quality standards for all criteria pollutants and has no maintenance area designations, CAA conformity requirements do not apply to federal agency actions related to the proposed project.

Table 5.7-3. Summary of Dispersion Modeling Results for the Kentucky Pioneer IGCC Demonstration Project Facility

		Maximum Modeled Concentration		PSD Rule Significant Impact Level		National Ambient Air Quality Standard	
Pollutant	**Averaging Time**	**Micrograms/ Cubic Meter**	**Parts Per Million**	**Micrograms/ Cubic Meter**	**Parts Per Million**	**Micrograms/ Cubic Meter**	**Parts Per Million**
Nitrogen Dioxide	Annual Avg	0.73	0.0004	1	0.0005	100	0.053
Sulfur Dioxide	3-hours	11.3	0.0043	25	0.0095	1300	0.5
	24-hours	2.4	0.0009	5	0.0019	365	0.14
	Annual Avg	0.33	0.0001	1	0.0004	80	0.03
Carbon Monoxide	1-hour	30.1	0.026	2000	1.747	40,000	35
	8-hours	7.71	0.007	500	0.437	10,000	9
PM_{10}	24-hours	4.87	na	5	na	150	na
	Annual Avg	0.57	na	1	na	50	na

Note: Except for the 24-hour PM_{10} value, maximum modeled concentration values are the highest values from five years of meteorological data. For PM_{10}, the reported 24-hour value is the maximum sixth-highest value for any of the five meteorological years.

All particulate matter emissions from combustion processes involving gaseous fuels would be in the size range collected by $PM_{2.5}$ samplers. Thus, all particulate matter emissions can be considered to be both PM_{10} and $PM_{2.5}$.

On February 27, 2001, the Supreme Court upheld EPA's authority to issue the $PM_{2.5}$ and 8-hour ozone standards. The Supreme Court decision effectively validated EPA's adoption of the $PM_{2.5}$ standards. A few relatively minor issues regarding the 8-hour ozone standard were returned to the DC Circuit Court of Appeals on remand, and the DC Circuit Court of Appeals had previously remanded a few issues regarding the 8-hour ozone standards to EPA for actions which were not appealed to the Supreme Court.

On November 14, 2001, EPA responded to the remand of the 8-hour ozone standard by re-evaluating the standards and then proposing to retain the same 8-hour ozone standard that had been adopted in 1997. On March 26, 2002, the DC Circuit Court of Appeals accepted EPA's proposed actions and dismissed all remaining challenges to the ozone and particulate matter standards. The 8-hour ozone standard still needs to go through the final rule-making process, but there is very little room for further legal challenges to the standards.

EPA has not yet promulgated any regulations that would implement the $PM_{2.5}$ standards in terms of state implementation plan requirements, PSD requirements, NSR requirements, or Title V requirements. EPA estimates that rulemaking to implement the $PM_{2.5}$ standards will not occur until some time in 2004 or 2005.

Source: EIV 2000.

Table 5.7-4. Lifetime Cancer Risk at Point of Maximum Downwind Exposure

Hazardous Air Pollutant	Averaging Time	Extrapolated Maximum Downwind Concentration		Assumed Lifetime Unit Risk Factor for Cancer	70-Year Exposure Cancer Risk (Chances per Million)
		Micrograms/ Cubic Meters	Parts per Million		
Arsenic	Annual Average	0.00030	na	4.3E-03	1.298
Benzene	Annual Average	0.00088	2.810	5.3E-05	0.047
Beryllium	Annual Average	0.00003	na	2.4E-03	0.072
Cadmium	Annual Average	0.00024	na	1.2E-02	2.882
Carbon Disulfide	Annual Average	0.000001	0.0021	na	na
Carbonyl Sulfide	Annual Average	0.00009	0.233	na	na
Chromium	Annual Average	0.00005	na	1.5E-01	8.233
Cobalt	Annual Average	0.00062	na	na	na
Formaldehyde	Annual Average	0.00154	1.886	1.3E-05	0.020
Hydrogen Sulfide	Annual Average	0.00013	0.342	na	na
Lead	Annual Average	0.00051	na	8.0E-05	0.041
Manganese	Annual Average	0.00020	na	na	na
Mercury	Annual Average	0.00003	na	na	na
Nickel	Annual Average	0.01565	na	2.6E-04	4.069
Selenium	Annual Average	0.00007	na	1.4E-04	0.010
Dioxins/Furans	Annual Average	0.00000088	na	3.8E+01	33.581
CUMULATIVE LIFETIME EXPOSURE RISK					**50.253**

Note:Maximum exposure concentrations scaled from dispersion modeling results for PM_{10} (for solid compounds) or NO_x (for gaseous compounds). Dioxins and furans are formed by high temperature combustion of fuels containing organic compounds, chloride compounds, and fluorine compounds. The synthesis gas will contain the types of compounds that can generate trace quantities of dioxins and furans in a high-temperature combustion process, and the gas turbines (not the gasification units) will provide the high-temperature combustion process in which the dioxins and furans can form. This analysis uses the emission rate limit specified in the facility PSD/Title V permit to estimate annual dioxin/furan emissions and resulting individual lifetime cancer risks. This is a very conservative estimate that overstates the actual impact; however, this is the only estimate available for this analysis.

5.8 Water Resources and Water Quality

This section discusses the potential effects of the construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility on water resources and water quality at the project site and surrounding area.

5.8.1 Methodology

The water resources and water quality analysis considers impacts to the Kentucky River, the waterbody with the most potential for impact as a result of project construction and operation. Potential impacts to water resources and water quality were assessed qualitatively and quantitatively by comparing projected impacts of construction and operation to existing water conditions of the Kentucky River.

5.8.2 Water Resources Impacts from No Action Alternative 1

Under No Action Alternative 1, DOE would not provide partial funding for the design, construction, and operation of the proposed project. Because no new construction would occur, there would be no impacts to water resources.

5.8.3 Water Resources Impacts from No Action Alternative 2

Under this alternative, a natural gas-fired power plant would be constructed that would essentially be identical to the power island constructed under the Proposed Action. Under this alternative, the plant would withdraw an estimated 3.8 million liters per day (MLD) (1 million gallons per day [MGD]) of surface waters. This water would be extracted from the Kentucky River. Since the average daily flow of the Kentucky River in the project vicinity was previously calculated to be 12.9 billion liters per day (3.4 billion gallons per day), and the withdrawals for this project would be 3.8 MLD (1 MGD), this additional withdrawal represents less than 0.03 percent of the average daily flow and should not noticeably impact water availability during average flow conditions. As discussed in Section 4.8, the 7-day flow with a recurrence interval of 10 years is 371.5 MLD (98.2 MGD) (UEC 1980). The daily withdrawals for the project would represent approximately 1 percent of this low flow average.

Although KPE would not be required to obtain its own water withdrawal permit from the State of Kentucky, it is useful to compare the expected withdrawals from this alternative to the KDEP, Division of Water's permit issuance guidelines. When issuing permits for water withdrawal, in order to ensure that sufficient flow is reserved for allocation to future users and to maintain water quality and stream habitat, the Kentucky Department of Environmental Protection (KDEP), Division of Water allocates no more than 10 percent of a stream's lowest average monthly flow to any one user. As discussed above, the daily withdrawals for this alternative would represent approximately 1 percent of the low flow average. Although it appears that the river should have adequate capacity, the ability of the river to support the withdrawal under various flow conditions will be further evaluated by the KDEP, Division of Water. KPE has indicated that it would be willing to work with the KDEP, Division of Water during low flow conditions and would cease plant operations if required. Minimal surface water would be consumed for the facility's construction.

Project operations would generate less than 1.5 MLD (0.4 MGD) of wastewater. Treated wastewater is expected to contain conventional pollutants such as nitrogen, phosphorus, total dissolved solids, and biological and chemical oxygen demand. This wastewater would be discharged into the Kentucky River via EKPC's existing 45.7-centimeter (18-inch) discharge. As discussed in Section 4.8, the Kentucky River currently receives treated wastewater from several permitted sources in the vicinity of the project site and water quality is sufficient to support all state designated uses. During the site-specific permitting process for obtaining a Kentucky Pollutant Discharge Elimination System (KPDES) permit for this project, pollutant loads on the river will be examined and discharge limits will be established that will be protective of water quality. Therefore, no adverse impacts to the Kentucky River are expected from the operation of the facility.

The facility would not use or intentionally discharge into groundwater resources during construction and operation. However, there will be potential groundwater contaminant sources present at the facility during both construction and operation. Oil and diesel fuel would be stored in clearly marked tanks onsite. The tanks would be provided with secondary containment structures. Construction equipment would be maintained regularly, and the source of leaks would be identified and repaired. Any soil contaminated by fuel or oil spills would be removed and disposed at an approved disposal site. Lubricating oils, acids for equipment cleaning, and concrete curing compounds are potentially hazardous wastes that may be associated with construction activities. These would be placed in containers within secondary containment structures onsite, and disposed of at a licensed treatment and/or disposal facility in accordance with local or state regulations and in compliance with the manufacturer's recommendations. Paint containers would be tightly sealed to prevent leaks or spills. Excess paint would be disposed of consistent with the manufacturer's recommendations and according to applicable governmental regulations.

In order to further protect groundwater, preparation and implementation of a groundwater protection plan, in compliance with 401 KAR 5:037, would likely be required. In this plan, technological means for protection of groundwater would be identified, taking into account the nature of the potential pollutants and the hydrogeologic characteristics of the area. These could include, but are not limited to, operational procedures, personnel training, spill response capabilities, best management practices, runoff or infiltration control systems, and siting considerations.

Once the plant is operational, a Spill Prevention, Control, and Countermeasure (SPCC) Plan would be developed and implemented pursuant to 40 CFR 112. The SPCC Plan would be part of the overall groundwater protection plan and would require construction measures (such as dikes or berms around certain storage tanks), inspections, and personnel training to prevent the occurrence of spills which could impact soils and groundwater.

The floodplain is defined as the lowlands adjoining inland and coastal waters and other relatively flat and flood-prone areas including, at a minimum, any area inundated by a 1 percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain. The facility is located above both the 100-year and the 500-year floodplains. The water intake is located within the river channel and is not considered to be within the 100-year floodplain. As part of the power island facility construction, this intake structure would be extended within the Kentucky River. To support this extension, minor construction activity would be required alongside the river channel on the river bed. Pursuant to the *Clean Water Act,* permits under Section 401 and Section 404 would be required for this action; however, only minor activity would occur and there would be no impact to the floodplain.

Since there are no identified wetlands in the project area, no impacts to wetlands would be expected.

5.8.4 Water Resources Impacts from the Proposed Action

The Proposed Action would use more water and generate more wastewater than No Action Alternative 2. The water requirements for the power island would be the same as No Action Alternative 2; however, the gasification island would require more water for operations and would generate more wastewater.

The Kentucky Pioneer IGCC Demonstration Project facility would withdraw a total of 15.1 MLD (4 MGD) of surface waters. The water would be used in the following processes: 3.8 MLD (1.0 MGD) for the gasification and process water, 3.0 MLD (0.8 MGD) for turbine condenser makeup, 3.0 MLD (0.8 MGD) for fuel gas moisturization and injection, and 3.8 MLD (1.0 MGD) would be for miscellaneous uses. Project operations would generate 1.5 MLD (0.4 MGD) of process wastewater. The other 13.6 MLD (3.6 MGD) is used in the operation of the gasifier, turbine condenser, and fuel gas saturation process, as well as other miscellaneous uses. This water would be extracted from the Kentucky River. As mentioned above, daily

withdrawals of more than 37,854 liters (10,000 gallons) require a state water withdrawal permit in accordance with 401 KAR 4:010 and 4:200; however, because the daily water requirement for the site will be supplied via a pipeline owned and operated by EKPC, it is likely that EKPC will simply request that their water withdrawal permit be amended to reflect the additional withdrawal of water for the project. Since the average daily flow of the Kentucky River in the project vicinity was previously calculated to be 12.9 billion liters per day (3.4 billion gallons per day), and the withdrawals for this project would be 15.1 MLD (4 MGD), this additional withdrawal represents approximately 0.1 percent of the average daily flow and should not noticeably impact water availability during average flow conditions. As discussed in Section 4.8, the 7-day low flow with a recurrence interval of 10 years is 371.5 MLD (98.2 MGD). The daily withdrawals for the project would represent approximately 4 percent of this low flow average.

Although KPE would not be required to obtain its own water withdrawal permit from the state, it is useful to compare the expected withdrawals from this alternative to the KDEP, Division of Water's permit issuance guidelines. When issuing permits for water withdrawal, in order to ensure that sufficient flow is reserved for allocation to future users and to maintain water quality and stream habitat, the KDEP, Division of Water allocates no more than 10 percent of a stream's lowest average monthly flow to any one user. As discussed above, the daily withdrawals for this alternative would represent approximately 4 percent of the low flow average. Although it appears that the river should have adequate capacity, the ability of the river to support the withdrawal under various flow conditions will be further evaluated by the KDEP, Division of Water. KPE has indicated that they would be willing to work with the KDEP, Division of Water during low flow conditions and would cease plant operations if required. Minimal surface water would be consumed for the facility's construction.

The existing water intake structure would be extended within the Kentucky River. As discussed in Section 5.8.3, this action would not affect the floodplain, nor would any action associated with the Kentucky Pioneer IGCC Demonstration Project. However, pursuant to the *Clear Water Act*, permits under Section 401 and Section 404 would be required for this action because floodplain construction includes the channel as well as the adjacent land.

Project operations would generate 1.5 MLD (0.4 MGD) of wastewater. The composition of this wastewater is expected to be the same as described above for No Action Alternative 2, and the same KPDES permitting process would be followed.

The storage and handling of feed materials including coal and RDF could present potential new groundwater contamination sources that would not exist under No Action Alternative 2. However, these materials will be rail shipped to the site, and unloaded, stored, and conveyed in enclosed structures with concrete floors. These materials will therefore have no potential to contact the ground or be leached and transported by rainfall to the subsurface.

Wastewater generated from the proposed project would be treated and discharged to the Kentucky River in accordance with the KPDES permit, which is protective of water quality. As a result, no adverse impacts to the public or Kentucky River Basin are expected to occur. The Water Resources Branch pays particular attention to the proximity of wastewater discharges to drinking water intakes. New sources of wastewater are prohibited within 8 kilometers (5 miles) of a wastewater treatment plant intake. This 8-kilometer (5-mile) limit was established to provide an additional layer of protection for the water quality found at drinking water intakes over treatment alone and is referred to as Zone 1. Zone 2 extends from 8 to 16 kilometers (5 to 10 miles), while Zone 3 is the area from 16 to 40 kilometers (10 to 25 miles) from a Water Treatment Plant intake. The proposed outfall from the project is located in Zone 3 for the Winchester Water Treatment Plant. Water collected at the treatment plant is tested and treated to meet all federal and state requirements concerning drinking water quality. Therefore, no impacts to drinking water are expected.

5.9 Ecological Resources

This section discusses the potential effects of the construction and operation of the Kentucky Pioneer IGCC Demonstration Project on the ecological resources at the proposed project location and the surrounding area.

5.9.1 Methodology

The ecological impact analysis was accomplished by reviewing site documentation and previously published environmental analysis documentation, conversing and corresponding with EKPC's Manager of Natural Resources and Environmental Communications, and corresponding with the U.S. Fish and Wildlife Service (USFWS).

5.9.2 Ecological Resource Impacts from No Action Alternative 1

Under No Action Alternative 1, there would be no changes in land use at the proposed site. Therefore, there would be no identified adverse impacts to ecological resources from No Action Alternative 1.

5.9.3 Ecological Resource Impacts from No Action Alternative 2

No Action Alternative 2 differs primarily from the Proposed Action in that the gasification island and storage building for a 10-day supply of coal and RDF pellets would not be constructed. Thus, the site-specific ecological impacts of No Action Alternative 2 are similar to the Proposed Action. The proposed transmission line, approximately 27 kilometers (17 miles) in length, would be constructed under both alternatives to support the power island. The ecological consequences of transmission line construction and operation will be addressed in a NEPA document that would be prepared in accordance with the U.S. Department of Agriculture's Rural Utility Service NEPA regulations.

5.9.4 Ecological Resource Impacts from the Proposed Action

Approximately 4.8 hectares (12 acres) of old-field vegetation and habitat would be lost from construction and operation of the Kentucky Pioneer IGCC Demonstration Project with an additional 2.8 hectares (7 acres) lost from the construction of the coal and RDF storage facilities. During site clearing activities highly mobile wildlife species or wildlife species with large home ranges (such as deer and birds) would be able to relocate to adjacent undeveloped areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. Species relocation may result in additional pressure to lands already at or near carrying capacity. The impacts could include overgrazing (in the case of herbivores), stress, and over-wintering mortality. For less mobile species (reptiles, amphibians, and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators. In addition to the areas to be disturbed, there would be a decrease in quality of the habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. The adjacent habitat also would experience a loss of quality from the reduction in size, fragmentation of the habitat and restriction on mobility for some species (Kelly and Rotenberry 1993).

Given the height of the gasifier stacks, 65 meters (213 feet), the Federal Aviation Administration will require stack lighting. Published accounts of avian collisions with tall, lit structures date back in North America to at least 1874. At least 350 species of Neotropical migratory songbirds are particularly vulnerable to communication tower collisions during their nighttime spring/summer and fall/winter migrations (Manville 2000; Manville 2001). Collisions are especially pronounced when foggy, misty, low-cloud-ceiling conditions exist. The problem has been brought to the forefront with the proliferation of open structured

communications towers and their associated guy wires that have been conservatively estimated to kill 4 to 5 million birds per year (Manville 2000). Differences do exist between solid towers and communications towers with the solid towers being less of an avian threat. Solid tower lighting is the critical consideration for their operation. Under the *Migratory Bird Treaty Act* of 1918, as amended, the USFWS is responsible for the conservation and management of 836 species of migratory birds. To minimize bird strike mortality, the USFWS recommends voluntary compliance with the *Service Interim Guidelines for Recommendations on Communications Tower Siting, Construction, Operation, and Decommissioning* and, for tower construction and operation, the use of low intensity white strobe lights programmed with the maximum off phase of 3 seconds (Manville 2001). The gasifier stacks lighting system will be designed in consideration of USFWS recommendations.

Section 7 of the *Endangered Species Act* requires all federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect listed species. An initial comment by the USFWS expressed concern regarding the federally-endangered running buffalo clover (USFWS 2000b). The proposed site location does not contain suitable habitat for running buffalo clover. Original habitat for this species were areas of rich soils in the transition zone between open forest and prairie where some shade and water is available, and most are now discovered in areas receiving at least some disturbance such as grazing and mowing. Based on the habitat requirements for this species, it is not expected to inhabit the project site. This expectation has been confirmed by field surveys performed by EKPC biologists. Therefore, there is no effect to running buffalo clover expected either from the construction or operation of the Kentucky Pioneer IGCC Demonstration Project. No other species of federal or state listing are known to be present at the proposed site location or are expected to be potentially affected by the operation of the Kentucky Pioneer IGCC Demonstration Project.

No riparian habitat would be lost due to operation of the water intake and discharge lines (KPE 2001). Surface water impacts resulting from approximately 15 MLD (4 MGD) of river water withdrawal include reductions in river flow and entrainment of aquatic organisms. Current federal regulation requirements for intake design require intake flow rates to be below that which could cause entrainment of aquatic resources. The plant and the intake have not been designed and will not be until the U.S. Army Corps of Engineers (USACE), Louisville District permit is issued, DOE funding approved, financing is secured, and the plant process design is finalized. However specific intake design criteria stipulated by USACE will be followed. The methods include use of leaky or porous dikes, infiltration beds, wells, and wire screens covering the intake.

Approximately 1.5 MLD (0.4 MGD) may be discharged back into the Kentucky River through the discharge line in place since the 1980s. Use of cooling towers will reduce the amount of rejected heat carried by the thermal plume mitigating the subsequent effect on aquatic organisms. Generally, the cooling towers will be high efficiency and the wastewater stream volume may approach zero, because the gasification technology is a substantial water user and typically reuses water from other various parts of the process and plant (KPE 2001). The Kentucky Natural Resources and Environmental Protection Cabinet has established regulatory limits relative to the Kentucky River that explicitly provide a process to establish thermal impact parameters. Kentucky regulations (401 KAR 5:031) contain specific, seasonal temperature limits upon which permitted effluent limits are based. Effluent temperature would be established and specified to avoid impacting the monthly Kentucky River receiving stream limits. Data regarding the quantity of water and temperature of the thermal plume associated with the cooling towers will not be available until data can be obtained after detailed facility design. However, a reasonable bounding scenario for the thermal plume's potential affects on aquatic biota is established by the thermal plume characteristics extensively modeled for the J.K. Smith Power Station Units 1 & 2 proposed for construction in the 1980s. Modeling data generated indicated that the thermal plume under average and worst-case conditions would be very small, respectively occupying approximately 0.7 and 0.8 percent of the river cross section at the 2.8°C (5.0°F) isotherm. Mixing of the thermal plume occurs rapidly, considering that average and worst-case plumes are within 2.8°C (5.0°F) of ambient temperatures at 3.1 meters (10.3 feet) and 5.4 meters (17.6 feet) from the discharge port,

respectively. Total plume travel time to the 2.8°C (5.0°F) isotherm is 2.6 seconds and 13.5 seconds for average and worst-case scenarios. Any organism entering the plume would be exposed to the high temperature regions of the plume for a maximum of less than 14 seconds (UEC 1980).

Although exposure in the plume from the point of discharge to the lower isotherms is theoretically capable of causing some fish mortality, actual mortalities are highly unlikely. The time required for fish body temperatures to approach equilibrium with the temperature of the surrounding water is measured in minutes, not seconds. Thus, mortality will probably not occur since body temperatures will not be significantly altered during the short period of plume passage. Fish are sometimes attracted to warm water when ambient temperatures are low. This may result in cold shock upon the return of the fish to the colder ambient water. The plume possesses high velocities and is elevated above the river bottom because of the buoyancy of warmer water. The high velocity prevents fish and other marine organisms from occupying the high temperature regions of the plume for significant periods of time. The plume location at the surface of the river removes it from the preferred bottom habitat of many species, further reducing the likelihood of fish attraction to the plume. Use of the bounding analysis indicates that benthic organisms most likely to be affected would be in close proximity to the discharge port. Mortality of benthic organisms may occur along with a potential shift in species populations or lack of recolonization of the affected area.

The small size of the plume, the rapid dilution attained and the higher induced velocities within the plume serve to reduce the chances of organism exposure to the discharge, limit the potential for attraction to the heated water, and restrict the amount of available space in the plume area. The impact of the thermal plume on the aquatic ecology of the Kentucky River would be minimal and limited to a small area. The existing discharge line conforms to KDEP requirements and any new discharge would similarly operate in compliance with KDEP requirements (KPE 2001).

5.10 Noise

5.10.1 Methodology

Because project-specific noise data are not available, noise impacts have been evaluated based on generalized equipment and industrial process noise considerations. General considerations of distance based noise attenuation have been used in evaluating off-site noise impacts. Noise from added train operations has been estimated using a passby event noise simulation model. The closest portion of Kentucky Highway 89 is about 1.6 kilometers (1 mile) from the project site, and the community of Trapp is about 3.2 kilometers (2 miles) from the main facility site.

5.10.2 Noise Impacts from No Action Alternative 1

No Action Alternative 1 would leave the project site in its existing condition. No energy production facilities would be constructed at the site, and no off-site alternative facilities would be constructed. Consequently, there would be no noise impacts from No Action Alternative 1.

5.10.3 Noise Impacts from No Action Alternative 2

No Action Alternative 2 would result in no DOE funding for the Kentucky Pioneer IGCC Demonstration Project, but KPE would build a natural gas-fueled combined-cycle plant at the J.K. Smith Site. Construction activities would be similar to those required for the proposed project, and the construction period would be 6 months.

As discussed in more detail for the Proposed Action, construction noise levels would be about 71 "A Weighted" (dBA) at a distance of 305 meters (1,000 feet) from the site, about 61 dBA at a distance of 762 meters (2,500 feet) from the site, about 50 dBA at a distance of 1.6 kilometers (1 mile) from the site, and about 44 dBA at a distance of 2.4 kilometers (1.5 miles) from the site. Construction activity generally would be limited to daytime hours. Construction noise levels would be similar to or less than background noise levels at locations beyond the EKPC property. As discussed in more detail for the Proposed Action, traffic associated with the construction workforce would increase highway traffic noise levels along nearby portions of Kentucky Highway 89 by about 3 dBA.

No Action Alternative 2 also would require construction of a 138-kV transmission line connecting the site to the local power grid. Construction of the 138-kV transmission line to the Spencer Road Terminal of the local power grid would generate short-term construction activity at off-site locations. Right-of-way clearing, rough grading, and erection of transmission line facilities would create localized noise impacts along the transmission line corridor. Noise levels generated by transmission line construction would be less than the construction noise levels generated at the Kentucky Pioneer IGCC Demonstration Project site.

Operational noise levels under No Action Alternative 2 would be similar to those discussed for the Proposed Action, since the CTs and associated generating equipment would be the dominant noise sources in either case. No Action Alternative 2 would not have additional noise sources such as the gasifier facility, fuel unloading and handling equipment, or sulfur recovery equipment. Generating plant operating noise levels would be about 62 dBA at the perimeter of the power plant site, 56 dBA at the EKPC property boundary, 53 dBA at the closest structure outside the EKPC property, and 44 dBA in the community of Trapp. The noise levels beyond the EKPC property boundary are compatible with rural residential land uses.

No Action Alternative 2 would not require any additional rail traffic for the power plant site. In addition, the workforce required for facility operation would be somewhat smaller than the work-force required for the Proposed Action. The facility would employ 24 people during the operation phase. Resulting traffic volumes would be about 20 vehicles at any shift change period. This small increment of additional traffic would not have a significant impact on highway traffic noise conditions in the area.

5.10.4 Noise Impacts from the Proposed Action

Construction activities on the proposed Kentucky Pioneer IGCC Demonstration Project would last for about 30 months. Construction noise generally would be dominated by noise from heavy equipment and heavy trucks. Power tools and other noise sources would make limited contributions to overall construction noise until construction activity shifts to interior building finishing.

A conservative estimate of construction site noise has been developed by assuming an average of about 20 heavy equipment items of various types operating in the same general area over a 10-hour workday. Hourly average noise levels during the active workday would average 90 to 92 dBA at 30.5 meters (100 feet) from the worksite. Distance attenuation and atmospheric absorption would reduce construction noise levels at greater distances. Estimated noise levels would be about 71 dBA at 305 meters (1,000 feet), 61 dBA at 62 meters (2,500 feet), 50 dBA at 1.6 kilometers (1 mile), and about 44 dBA at 2.4 kilometers (1.5 miles). Actual noise levels probably would be less than these estimates due to terrain and vegetation effects. There are very few residences within 1.6 kilometers (1 mile) of the project site, and nighttime construction activity is not anticipated. Construction noise levels would be similar to or less than background noise levels at locations beyond the EKPC property.

KPE has indicated that the construction workforce will vary in size over the facility construction period, and may be as high as 1,000 for short periods of time. On average, construction activity at the Kentucky Pioneer IGCC Demonstration Project site probably would double current traffic volumes on the adjacent portions of Kentucky Highway 89. Because of the logarithmic nature of decibel units, a doubling of traffic volume would result in a 3 dBA increase in highway traffic noise levels. Additional truck traffic generated by construction activity would produce some additional noise level increases along affected highways.

The major noise sources associated with facility operations are expected to be the gas turbine units and the gasifier units. Other less significant noise sources would include material unloading facilities, conveyor systems, cooling tower operations, rail traffic to and from the facility, and vehicle traffic to and from the facility.

Noise levels inside the turbine buildings would be very high, about 155 dBA (EIV 2000). The building enclosing the turbine units would provide a substantial reduction in noise levels at outside locations. Noise levels inside the gasifier building would be relatively high, about 95 dBA (EIV 2000). The building enclosing the gasifiers would provide a substantial reduction in noise levels at outside locations.

Studies conducted by KPE indicate that operational noise levels are expected to be 62.4 dBA at the perimeter of the project site, 56.5 dBA at the EKPC property boundary, 53.4 dBA at the closest structure outside the EKPC property, and 44.7 dBA in the community of Trapp. The noise levels beyond the EKPC property boundary are compatible with rural residential land uses.

RDF pellets and coal would be brought to the site by rail. The facility would require the equivalent of 25 rail cars per day each of RDF pellets and coal. Actual rail shipments would be done by unit trains, with an average of two RDF trains and two coal trains per week. On average, there would be about one train movement into or out of the site each day, although there might be two train movements on some days.

The increased rail traffic required to bring RDF pellets and coal to the site would have only minor effects on noise levels along the affected rail lines. While individual train passbys may be heard over a distance of about 1.6 kilometers (1 mile), effects on ambient day-night average sound (L_{dn}) levels would be minor. In general, it takes a doubling of noise source activity to cause a 3 decibel (dB) increase in noise levels. One or two additional trains in one day would not be a large increase over existing mainline rail operations, and thus would not have much effect on existing noise levels along the mainline tracks. The

incremental noise impacts of typical unit train operations delivering RDF pellets or coal to the project site are summarized in Table 5.10-1.

Table 5.10-1. Noise from Passby Events 24-Hour L_{dn} (dBA)

Distance from Rail Line (ft)	Maximum Passby Noise	Average Passby Noise	1-Hour Average Noise	One Train Per Day	Two Trains Per Day
100	85.3	80.6	66.3	53.4	56.0
200	82.1	77.3	63.1	57.1	53.3
500	76.8	72.6	58.4	48.6	50.0
1,000	68.3	68.3	54.3	47.4	48.1
2,500	61.0	60.9	47.6	46.6	46.8
5,000	52.5	52.3	42.3	46.4	46.5

Analysis assumes 2 locomotives and 100 railcars, a total train length of 6,130 feet, and a speed of 35 mph. All train operations assumed to be daytime events. Background noise levels assumed to be 40 dBA.

Vehicle traffic to and from the site would be a minor addition to the noise environment of areas along Kentucky Highway 89. The facility is expected to employ a workforce of 120, distributed into multiple work shifts over a 7-day work week. Resulting traffic volumes would be less than 80 vehicles at any shift change period. This small increment of additional traffic would not have a significant impact on highway traffic noise conditions in the area.

5.11 Traffic and Transportation

This section summarizes the potential impacts related to road and railway traffic and transportation associated with the construction and operation of the proposed Kentucky Pioneer IGCC Demonstration Project. The methods of analysis for assessing the impacts are also discussed.

5.11.1 Methodology

Impacts are analyzed in comparison to traffic data for the ROI presented in Section 4.11. As stated in Section 4.11.1, capacity studies have not been conducted for the highways analyzed in this section. Based on capacity studies conducted on similar roads throughout the country, the capacity for all roads in this analysis is assumed to be 1,000 vehicle trips per hour. Recent and estimated road traffic data for routes most likely to be traveled to the project site from the main traffic arteries is presented in Table 4.11.1-1. For the purposes of presenting a worst-case bounding study, it is assumed that all vehicle trips occur during 12 daylight hours, half of the estimated counts are traveling in each direction. Half of the trips taken in each direction occur during one of two 2-hour commuting periods. The commuting periods are established as 7:30 a.m. to 9:30 a.m. for the morning commute, and 4:30 p.m. to 6:30 p.m. for the evening commute. For example, the year 2001 estimated count given for Kentucky Highway 89 between milepost (MP) 15.5 and MP 16.0 in Clark County is 10,600 vehicle trips per 24-hour period. Based on the assumptions made, all of these vehicle trips would occur during 12 hours of daylight and half of them, or 5,300, would be traveling each direction on the road. Half of these 5,300 vehicle trips, or 2,650 trips, would occur during the given commuting time for that direction. Established commuting patterns indicate that the morning commute vehicle trips would be toward the centers of population, such as Winchester, Richmond, and Lexington, while the evening commute vehicle trips would be away from them. During the morning commute on this section of road, 1,325 vehicle trips per hour would be made toward Winchester and during the evening commute, the same number would be made heading away from Winchester. During these periods, the established road capacity would be exceeded and traffic jams would be expected to occur. During the other 10 hours of daylight, the remaining 2,650 vehicle trips would occur in each direction on this section of the highway, resulting in an average of 265 vehicle trips per hour.

The existing data indicate that traffic on each road increases as one travels towards the centers of population. It also indicates that traffic on roads near the project site is relatively light. Based on year 2001 estimated vehicle trips and the methodology established in the previous paragraph, non-commute traffic on local roads in the community of Trapp ranges from 5 to 15 vehicle trips per hour in each direction.

For the purpose of this analysis, other assumptions are also made. To further the presentation of the potential worst-case scenario, it is assumed that all workers would drive themselves to work. A more likely scenario, however, is that some of the cars would have more than one occupant. The range of potential impacts reflects an estimated range of 1.0 to 1.2 occupants per vehicle. The worst-case bounding analysis would be only 1.0 occupants, thus requiring more vehicle trips to transport all of the required workers to the site. The lower number represents the best-case scenario of 1.2 occupants per vehicle. KPE has indicated that 20 to 30 heavy-duty trucks per day will be entering and leaving the site during peak construction periods. Since durations of peak construction have not been indicated and to present a worst-case scenario for traffic impacts to the community and ROI, it is assumed that 30 trucks per day enter and leave the site throughout the construction of the facility. This would equate to an additional 60 vehicle trips per day on local roads or 8 vehicle trips per hour, assuming an 8-hour work day.

KPE has indicated that it requires 2,268 metric tons (2,500 tons) per day each of RDF pellets and coal to operate the proposed gasification facility, as well as approximately 127 metric tons (140 tons) per day of limestone. For delivery purposes, a truck is assumed to haul 18 metric tons (20 tons) of coal per load and a railcar is assumed to haul 91 metric tons (100 tons) of coal per load. The coal has a greater density than the RDF and thus, the RDF requires a larger volume container to transport the equivalent mass of material. Each truck or railcar would have a fixed volume that it would be capable of transporting. The 44-56 mix of

coal and RDF by volume previously established in Section 3.2, Fuel Source, indicates that 1.2 times as many trucks or railcars would be required to ship the 2,268 metric tons (2,500 tons) of RDF as would be required to ship a thermal equivalent amount of coal. Due to the comparatively small amount of limestone required for facility use, it is assumed that it has the same density as coal and would require the same number of trucks or railcars to transport equivalent amounts. This equates to 125 truckloads of coal, 150 truckloads of RDF, and 7 truckloads of limestone per day of plant operation, or a total of 282 truckloads per day delivered to the site. This is equivalent to 564 additional vehicle trips in and out of the site per day of operation. Since the plant would operate 24 hours a day, this averages to 23.5 truck trips in and out of the site per hour. The railcar equivalents to supply the plant would be 25 railcars of coal, 30 railcars of RDF pellets, and 1.4 railcars of limestone per day, or a total of 56.4 railcars per day of operation. Given the existing railroad infrastructure at the site, and that the amount of truck traffic required to supply the plant on a daily basis renders delivery by truck almost infeasible, KPE has indicated that all raw materials would be supplied to the proposed plant by rail. The remaining required raw material, petroleum coke, is only needed for the cold-start of a gasifier, which is a very infrequent event, and thus, this analysis assumes that petroleum coke deliveries are included in the established railcar traffic to the site.

5.11.2 Traffic and Transportation Impacts from No Action Alternative 1

Under No Action Alternative 1, no facility would be constructed or operated at the J.K. Smith Site. Therefore, no additional traffic to the site would be required and no impacts would occur to traffic and transportation in the ROI.

5.11.3 Traffic and Transportation Impacts from No Action Alternative 2

Under No Action Alternative 2, the power island facility is constructed at the J.K. Smith Site. During construction, between 100 and 120 vehicle trips would be made on Kentucky Highway 89 prior to and after each work shift. This number could reach as high as 200 trips during peak construction periods. Since existing traffic is light, these additional trips would have little impact to regional traffic. The only exception would be at the intersection of the site access road and Kentucky Highway 89, which could see some back-up at the beginnings and ends of work shifts. Further discussion is presented in the Proposed Action analysis that follows.

The power island would run on natural gas and no raw material would be supplied by rail on a daily basis, therefore no impacts would occur to railroads in the area. The plant would employ 24 people during the operations phase, which would require an additional 48 vehicle trips per day to and from the site. Existing traffic levels in the area indicate that this small number of additional vehicle trips should result in no significant impacts to traffic in the ROI.

5.11.4 Traffic and Transportation Impacts from the Proposed Action

Under the Proposed Action, the gasification island would be constructed and operated at the existing power island site. Construction of the facility is assumed to take 30 months and employ an average of 600 people, with peak employment rising to 1,000 people. During periods of average construction worker staffing, an additional 1,000 to 1,200 vehicle trips would occur in the ROI, 500 to 600 at the beginning of the shift and 500 to 600 at the end of the shift. This number would increase to as high as 2,000 vehicle trips per day during periods of peak construction, 833 to 1,000 at the beginning of the shift and 833 to 1,000 at the end of the shift. These vehicle trips would all occur within a relatively short timeframe as workers arrive for the beginning of their shift and depart at the end. In addition, 30 heavy-duty trucks would operate in and out of the site throughout the workday, adding approximately 8 vehicle trips per hour worked to local roads.

The site location is inherently beneficial to traffic approaching and leaving during regular work hours as it is not near a population center. The majority of the existing morning and evening traffic heads respectively toward and away from Winchester and Richmond along the routes being analyzed while traffic

generated by the construction of the Proposed Action would be headed toward Trapp in the morning and away from Trapp in the evening. Thus, all traffic generated by the Proposed Action would move in opposite directions of existing heavy flows and would not compound any existing traffic problems during commuting periods. Another reason that traffic generated by workers driving to and from the site should not impact existing traffic flows is that the typical construction shift begins and ends comparatively early in the day, around 7:00 a.m. and 3:00 p.m., respectively. Workers are already onsite and home when the respective commuting periods begin.

Significant traffic impacts would occur to the roads in Trapp, especially to Kentucky Highway 89 at the intersection with the site access road. The lack of traffic control devices could lead to significant traffic congestion at this intersection before and after shifts. The two-lane access road would also be heavily congested prior to and after work shifts, as all vehicles must utilize this road. Though the number of vehicle trips generated by the Proposed Action would not be high enough to exceed hourly capacities on any route to the project site, shorter-term capacities may be exceeded as all workers are traveling to and from the site during the same time period. Kentucky Highway 89 would be especially susceptible to this and it would result in periods of minor congestion along the route. Mitigation measures to alleviate any impacts are suggested in Section 5.18 , Mitigation, of this EIS.

One potential issue of concern, especially as the construction shifts end, is the presence of schoolbuses along Kentucky Highway 89. The Transportation Division of the Clark County School Board indicates that schoolbuses operate along this road between 2:50 and 4:30p.m., which coincides with the end of construction work shifts. The Transportation Division indicates that approximately 30 bus stops lie within a 9.6-kilometer (6.0-mile) stretch of Kentucky Highway 89 north and south of the intersection with the plant access road. The safety of the children should not be an issue since the buses stop at the homes of each of the children and not at centralized locations, thus minimizing the amount of walking along the road. The frequent stops required by the schoolbuses combined with the large number of vehicles leaving the plant site would increase the incidences and duration of congestion along Kentucky Highway 89.

The majority of the truck traffic generated by the construction of the facility would be to supply construction materials and to dispose of construction wastes. Truck trips would occur at the average rate of eight per hour, or one every 7.5 minutes, during the workday. The trucks disposing of construction wastes would travel to and from the nearest landfills accepting construction debris, which are located in Montgomery and Estill Counties. The routes to and from the landfills are lightly traveled, two-lane state highways. New truck traffic on these routes should have little to no impact on existing traffic. Trucks carrying construction supplies would most likely operate on the same routes established in Section 4.11.1. Since trucks would only operate during the workday, they should have little to no impact on existing traffic along these routes. Minor impacts, such as a slowing of average traffic speeds, may result as the trucks move through populated areas toward the construction site.

Large construction materials and supplies, such as the gasifier units and steel, would be delivered by rail to the project site. Rail transportation during construction would typically occur during construction shift hours. Specific impacts to rail traffic cannot be analyzed as existing rail traffic data is unavailable; however, they would most likely be relatively minor as deliveries to the site would be coordinated by CSX Transportation, Inc., the owner of the rail line, to accommodate and facilitate all rail traffic on the line. At the site, the supply trains would travel off of the main rail line and onto the existing rail loop, where they would be unloaded. Since the trains would be completely off of the main line, no delays to mainline rail traffic would be expected during the unloading process. All construction-related traffic and transportation impacts would only occur during the 30-month construction period and would cease once construction was completed and the operation phase of the facility began.

All trucks used for the construction and operation of the facility would haul a maximum of 18 metric tons (20 tons) of weight. Kentucky Highway 89 has a maximum allowable legal gross weight of 36 metric tons (40 tons) for trucks with five or more axles. According to the Kentucky Transportation Cabinet, any

vehicle traveling on Kentucky Highway 89 below the weight indicated should not cause any damage to the roadway.

Operation of the proposed facilities would employ 120 workers. Approximately 200 to 240 vehicle trips would be generated by the operations workers, 100 to 120 at the beginning of shifts and 100 to 120 at the end of shifts. These trips would be spread throughout the day, based on shift start and end times, because facility operation would require staff onsite at all times. The small number of additional vehicle trips required at any given time should not present a significant impact to any of the routes approaching the site location. The lack of traffic control devices may cause minor temporary congestion at the intersection of Kentucky Highway 89 and the site access road as shifts begin and end. Temporary congestion may also be experienced along the site access road as shifts begin and end.

Raw material for the operation of the gasifier units would be supplied to the site by rail. As stated earlier, the facility would require 56.4 rail cars of raw material supplies per day to operate, 30 cars of RDF pellets, 25 cars of coal, and 1.4 cars of limestone. All shipments would be made in covered railcars and the RDF would be further encased in sealed containers. This equates to approximately 4 unit trains of 100 cars each per week to supply raw materials to the site. Eight train movements per week, or about one a day, would be required at the site. Each train movement incorporates either moving a unit train on or off of the main rail line. The addition of one train per day along rail line segment C-273, which is the equivalent of a 7.6 percent increase in traffic, would have little or no effect to traffic along the rail line segment, as deliveries to the site would be coordinated by CSX Transportation, Inc., the owner of the rail line, to accommodate and facilitate all rail traffic. The existing rail infrastructure, including the rail loop and yard capacity, at the project site is sufficient to remove the full unit train from the mainline for unloading of raw materials. All required rail movements onsite would be handled within existing capacity and would not impact the mainline. Therefore, rail traffic generated by the project is expected to have minor impacts to existing rail traffic on the mainline. Noise impacts associated with the additional rail traffic are addressed in Section 5.10.

Any disruption to rail traffic, such as an accident on the line, may require raw materials to be supplied to the facility by truck instead of rail, though this scenario is extremely unlikely to occur. As stated earlier, the equivalent number of trucks required for daily delivery of raw material to the project site is 282. This would equate to 564 truck trips in and out of the site each day, or one truck trip every 2.5 minutes during a 24-hour period, and would result in adverse impacts to local traffic. Truck traffic would significantly impede existing traffic in the area and Kentucky Highway 89 would receive an essentially endless flow of trucks. The 282 trucks required to supply the plant each day would significantly affect other materials transport throughout the ROI as significantly fewer trucks would be available to ship other goods. Measures taken by KPE to avoid relying on trucks to supply raw materials to the site include the construction of materials storage facilities and the large rail yard capacity onsite. Storage facilities would house enough raw materials to supply the facility during any minor interruptions in rail service. The yard capacity at the site is sufficient to handle two unit trains, which could provide extra storage capacity during longer interruptions of rail service.

The facility would generate between 454 and 635 metric tons (500 and 700 tons) of frit per day. Should the frit prove to be marketable, the quantity generated would require the use of train transportation offsite. A maximum of seven railcars per day would be required to transport the frit. Any solid wastes generated during construction and operation would be transported to local landfills in Montgomery and Estill Counties via trucks. This traffic would be minor since it is expected that limited amounts of waste would require disposal.

An Emergency Response Plan and SPCC Plan, which outline and document procedures for providing emergency response and cleanup for any any project-related spills or accidents during materials and waste transport, have not yet been developed by KPE. These plans will be developed during the engineering and construction phases of the project and would adhere to local, state, and federal regulations.

5.12 Occupational and Public Health and Safety

This section presents potential health effects on both workers and the public from the proposed Kentucky Pioneer IGCC Demonstration Project.

5.12.1 Methodology

Occupational and public health and safety issues have been evaluated in the context of general air quality, noise, hazardous materials, and accidents. Air quality, noise, and water quality considerations are addressed in other sections. Analysis of the impacts to occupational and public health and safety consists of an evaluation of the effects caused by the construction and operation of No Action Alternative 2 and the Proposed Action on worker and public health and safety. Health and safety programs would be developed to minimize worker and public health and safety risks during construction and operation of the proposed Kentucky Pioneer IGCC Demonstration Project facility.

5.12.2 Occupational and Public Health and Safety Impacts from No Action Alternative 1

No Action Alternative 1 would leave the project site in its existing condition. No energy production facilities would be constructed at the Kentucky Pioneer IGCC Demonstration Project site. Consequently, there would be no occupational or public health and safety impacts from No Action Alternative 1.

5.12.3 Occupational and Public Health and Safety Impacts from No Action Alternative 2

The level of risk to workers increases in relation to the amount of new construction required. Construction accident risks generally increase based on the length of the construction period. No Action Alternative 2 would involve the construction and operation of a natural gas-fired power plant and a 27-kilometer (17-mile) transmission line. It is anticipated that 120 workers would be employed during the average construction period and 200 during peak construction, with construction lasting approximately 6 months. Typical worker impacts present in the construction industry would be expected from the construction of the proposed Kentucky Pioneer IGCC Demonstration Project facility. During the construction, compliance with Occupational Safety and Health Administration (OSHA) construction safety standards would be the responsibility of the construction contractor selected for the project. Compliance with these standards would provide for basic standards of worker health and safety during construction and operation.

The potential noise impact to workers from heavy equipment operation and activities such as cutting metal or grinding operations could potentially pose higher noise levels to workers than noise during actual plant operations. Construction workers could potentially be exposed to airborne emissions from routine activities such as welding, soldering, grinding, painting, and cleaning operations. These exposures would be intermittent, but may be intense and would be evaluated at the time of construction. Appropriate health and safety measures would be implemented for all identified and anticipated hazards to worker health and safety. Therefore, the potential adverse impacts to worker health and safety during construction would be minimized.

Potential health impacts to the public associated with construction of No Action Alternative 2 or the Proposed Action include fugitive dust typical of construction sites and noise. Since the closest residence is approximately 1 mile away from the proposed site, the public would not be affected by construction-related noise and fugitive dust emissions.

During plant operation, possible worker and public health effects could occur as a result of fire or a natural gas explosion. Fire and explosion hazard issues would be addressed through basic facility design considerations. Therefore, the likelihood of fire or explosion from the installation of new pipelines would be small.

5.12.4 Occupational and Public Health and Safety Impacts from the Proposed Action

Since construction accident risk increases based on the length of the construction period, potential construction risks would be greater under the Proposed Action because several additional facilities (gasification plant, sulfur removal and recovery facility, air separation facility, and RDF pellet and coal storage areas) would be constructed. It is anticipated that 600 workers would be required during the average construction period and 1,000 workers during peak construction with a construction period of approximately 30 months. Other impacts from the construction of the Kentucky Pioneer IGCC Demonstration Project, including the 138-kV transmission line, would be similar to those detailed in the No Action Alternative 2 analysis.

Operation of the proposed facility would require an estimated 120 permanent workers and could increase risks to site workers from industrial-type work hazards and accidents. Impacts associated with operation of the gasification island component of the facility include the accidental or emergency release of raw syngas, acid gases or large quantities of fugitive particulate emissions from raw material (RDF pellet, coal, petroleum coke and limestone) handling. Accidental releases of raw syngas due to process interruptions or unplanned shutdowns would be prevented by the use of the emergency flare system. Unplanned shutdowns or process interruptions are expected to be rare occurrences and thus, the likelihood of raw syngas releases would be very low. Potential releases of fugitive dust emissions during material handling would primarily affect on-site workers but would be minimized or avoided by using covered conveyors and engineering controls. The potential for exposure to dust during maintenance and repair operations would be minimized by strict adherence to health and safety programs such as respiratory protection and confined space entry. This would minimize any potential worker impacts. Although there is some potential for fire or ignitability from coal and RDF storage, appropriate design and engineering controls would address these potential problems and minimize risks to workers.

The noise levels from the gasifier and turbines are expected to be 95 dBA to 155 dBA, respectively, and would pose a noise hazard to workers in those areas. Areas around such equipment would be posted as high noise areas and hearing protection would be required. A hearing conservation program would be developed by KPE. Buildings for the turbines and the gasification unit would be designed to reduce the noise levels outside of those areas. Facility operational noise generally would be less than ambient background noise conditions at locations outside the 1,263-hectare (3,120-acre) J.K. Smith Site. Even during quiet nighttime hours, noise from the proposed facility would be close to ambient noise levels at distances of more than 1.6 kilometers (1 mile). Noise from facility operations should not have a significant impact on ambient noise levels beyond the J.K. Smith Site.

Operation of the rail spur, loading and unloading facilities, and on-site material moving equipment could cause occupational hazards. However, potential risks would be minimized through worker training, routine internal inspections and conduct of safety meetings to reinforce workers' awareness of safety issues pertinent to the plant. The proposed project safety procedures would also include development of a site-specific safety manual.

Hazardous air pollutant emissions from the Proposed Action are discussed in Section 5.7, Air Resources. Dispersion modeling results in Table 5.7-3 show that criteria pollutant emissions from the proposed project would be well below NAAQS and PSD significant impact levels. Therefore, the incremental increase in air emissions from the Proposed Action would be very small and present little risk of adverse noncancer health effects.

Maximum downwind concentrations of hazardous pollutants expected to be emitted from the proposed facility and the associated maximum lifetime cancer risks are shown in Table 5.12-1. With the exception of benzene, carbon disulfide, carbonyl sulfide, formaldehyde, and hydrogen sulfide, all other hazardous pollutants would be associated with PM_{10} emissions. Dispersion modeling conducted for the PSD/Title V Permit Application indicates that the location of maximum 24-hour average and maximum

annual average PM_{10} concentrations would be within 0.8 kilometers (0.5 miles) of the facility, within the boundaries of the J.K. Smith Site property. PM_{10} concentrations (and consequently most hazardous air pollutant concentrations) beyond the boundaries of the J.K. Smith Site property would be less than the maximum values.

The cancer risk values in Table 5.12-1 are the incremental risk added by the Kentucky Pioneer IGCC Demonstration Project. The estimated incremental cancer risk from the Proposed Action is a very conservative estimate based on continuous exposure to hazardous pollutant emissions for 70 years. Most of that risk is attributable to potential dioxin/furan exposure (which may be overestimated by the extrapolation procedures used in the analysis). The cumulative estimated lifetime exposure risk (probability of developing cancer) of 5.0E-05 ($5x10^{-5}$) applies to the location of maximum annual average downwind impacts which is within the boundaries of the J.K. Smith Site. Cumulative estimated lifetime cancer risk for off-site locations would be much less than 5.0E-05 ($5x10^{-5}$) and further decrease with distance from the proposed project area. As shown, minor impacts are expected from the emission of hazardous air pollutants.

Table 5.12-1. Lifetime Cancer Risk at Point of Maximum Downwind Exposure

		Extrapolated Maximum Downwind Concentration			
Hazardous Air Pollutant	**Averaging Time**	**Micrograms/ Cubic Meters**	**Parts per Million**	**Assumed Lifetime Unit Risk Factor for Cancer**	**70-Year Exposure Cancer Risk (Chances per Million)**
Arsenic	Annual	0.00030	na	4.3E-03	1.298
Benzene	Annual	0.00088	2.810	5.3E-05	0.047
Beryllium	Annual	0.00003	na	2.4E-03	0.072
Cadmium	Annual	0.00024	na	1.2E-02	2.882
Carbon Disulfide	Annual	0.000001	0.0021	na	na
Carbonyl Sulfide	Annual	0.00009	0.233	na	na
Chromium	Annual	0.00005	na	1.5E-01	8.233
Cobalt	Annual	0.00062	na	na	na
Formaldehyde	Annual	0.00154	1.886	1.3E-05	0.020
Hydrogen Sulfide	Annual	0.00013	0.342	na	na
Lead	Annual	0.00051	na	8.0E-05	0.041
Manganese	Annual	0.00020	na	na	na
Mercury	Annual	0.00003	na	na	na
Nickel	Annual	0.01565	na	2.6E-04	4.069
Selenium	Annual	0.00007	na	1.4E-04	0.010
Dioxins/Furans	Annual	0.00000088	na	3.8E+01	33.581
CUMULATIVE LIFETIME EXPOSURE RISK					**50.253**

Fire and explosion hazard issues associated with the operation of the Proposed Action would be addressed through basic facility design considerations. Preliminary estimates of on-site hazardous material quantities indicate that quantities would be below the thresholds that would require preparation of a formal risk management plan (EIV 2000). No significant occupational or public health and safety impacts are expected from facility operations.

5.12.5 Electric and Magnetic Fields

Both current and voltage are required to transmit electrical energy over a transmission line. The electric field is a function of voltage carried by conductors and the conductor height aboveground. The magnetic field is a function of the amount of current carried by the line and the height of the conductors. Electric and magnetic field (EMF) effects are typically attenuated with distance from the conductors and vary along a transmission right-of-way. All devices that carry electric current (e.g., televisions, radios, computers)

are sources of EMF. The maximum magnetic fields of a transmission line are comparable with the maximum magnetic fields measured near some common household appliances.

For several years, there has been concern by some members of the scientific community and the public regarding human health effects from electromagnetic fields during the transmission of electrical current from power plants. In June 1999, the National Institute of Environmental Health Sciences released its report *Health Effects from Exposure to Power-line Frequency Electric and Magnetic Fields* (NIEHS 1999) which concluded that "extremely low-frequency electric and magnetic field exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard." While there is considerable uncertainty about the EMF/health effects issue, the following facts have been established from the available information:

- Any exposure-related health risk to the exposed individual will likely be small.
- The most biologically significant types of exposures have not been established.
- Most health concerns are about the magnetic field.
- The measures employed for such field reduction can affect line safety, reliability, efficiency and maintainability, depending on the type and extent of such measures.

No federal regulations have been established specifying environmental limits on the strengths of fields from power lines. However, the federal government continues to conduct and encourage research necessary for an appropriate policy on the EMF issue. Until more definitive evidence is available, little can be said with regard to the conclusions of these studies other than effects, if present, are small.

For the new 138-kV line, the electric field strength of approximately 1.5 kV per meter would result at the point of maximum strength within the right-of-way. This would decrease to about 0.04 kV per meter at about 61 meters (200 feet) away. The magnetic field at the same point of maximum impact would be less than 200 milligauss, and decreases to less than 6 milligauss at 61 meters (200 feet) away. For No Action Alternative 2, personnel working within the transmission line right-of-way would be exposed to EMF for short durations. Since EMF attenuate with distance from the conductors, exposures would be less with increased distance from the conductors. Because there is still scientific uncertainty about the long-term effects of EMF, the human health effects of EMF from the proposed facility cannot be fully evaluated at this time.

5.13 Waste Management

This section discusses the potential effects of construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility on waste management.

5.13.1 Methodology

The waste management impact analysis consists of an evaluation of the impacts generated by the construction and operation of No Action Alternative 2 or the Proposed Action. Waste management issues have been evaluated in the context of handling, storage, transportation, and disposal of solid and hazardous waste. Specific details on waste generation (e.g., waste volumes and types) will not be known until the plant is designed and operational. Assumptions have been made on the types of wastes expected to be generated based on wastes typical of other small to medium size power generating facilities.

Potential impacts from No Action Alternative 2 or the Proposed Action are qualitatively assessed. To determine if an action may cause a significant impact, both the context of the alternatives and the intensity of the impact are considered. For actions such as those proposed in this document, the context is the locally affected area and significance depends on the effects in the local area. Impacts would be significant if the Proposed Action would permanently affect waste management in the local area.

5.13.2 Waste Management Impacts from No Action Alternative 1

Under No Action Alternative 1, DOE would not provide partial funding for the design, construction, and operation of the proposed Kentucky Pioneer IGCC Demonstration Project and the proposed project would not be constructed. There would be no waste management impacts from No Action Alternative 1.

5.13.3 Waste Management Impacts from No Action Alternative 2

Under No Action Alternative 2, the power island component and transmission line of the Kentucky Pioneer IGCC Demonstration Project facility would be constructed regardless of whether DOE provides funding.

During construction of the proposed power island component, small quantities of industrial solid wastes and hazardous wastes would be generated. KPE would be responsible for storage and disposal of all generated wastes during construction of the proposed facility in accordance with applicable KDEP and *Resource Conservation and Recovery Act* requirements. The selection of waste disposal facilities has not been made but there are several solid waste disposal facilities in the State of Kentucky. Since the volume of solid waste to be generated during construction would be small, it is not expected to affect the life expectancy of solid waste facilities in the area. No impacts from solid waste would be anticipated.

The storage and use of fuel, lubricants and other fluids could create a potential contamination hazard during construction. Spills or leaks of hazardous fluids could contaminate soil and groundwater. The impact of leaks and spills would be minimized or avoided by restricting the location of refueling activities and by requiring immediate cleanup of spills and leaks of hazardous materials.

Oil and diesel fuel would be stored in clearly marked tanks onsite. The tanks would be provided with secondary containment structures. Construction equipment would be maintained regularly, and the source of leaks identified and repaired. Any soil contaminated by fuel or oil spills would be removed and disposed at an approved disposal site. Lubricating oils, acids for equipment cleaning, and concrete curing compounds are potentially hazardous wastes that may be associated with construction activities. These would be placed in containers within secondary containment structures onsite, and disposed of at a licensed treatment and/or disposal facility in accordance with local or state regulations and in compliance with the manufacturer's recommendations. Paint containers would be tightly sealed to prevent leaks or spills. Excess paint would

be disposed of consistent with the manufacturer's recommendations and according to applicable governmental regulations.

Sanitary wastes generated during operation would be treated in the plant wastewater treatment system. Treated wastewater would be discharged to the Kentucky River in accordance with the site-specific KPDES permit.

All hazardous and toxic waste generated during construction would likely be disposed of at out-of-state hazardous landfills since there are no hazardous waste disposal facilities in the State of Kentucky. Only small amounts of hazardous waste would be generated during construction and no impacts from hazardous or toxic materials are anticipated.

During plant operations, small quantities of industrial solid wastes would be generated. The expected waste streams include office garbage, liquid maintenance wastes, wastewater treatment sludge, and waste oil. Since the power island is still in the early planning phase, anticipated annual volumes of wastes are not yet known. By generating industrial solid waste, the Kentucky Pioneer IGCC Demonstration Project facility is subject to the provisions of 401 KAR 32.010. The facility is required to notify KDEP in writing of its status as a solid waste generator within 30 days after it first generates such wastes. An annual waste generation report is required to be submitted to KDEP pursuant to 401 KAR 32.040. A solid waste permit is not required since the plant would not dispose of solid waste onsite. Since the volume of solid waste expected to be generated during operation would be small, no impacts from solid waste are anticipated.

The quality of both the surface water and the groundwater could be affected in the event of potential spills or leaks from storage containers of fuel, lubricants, fluids, and chemicals. An SPCC Plan would be developed during the detailed design of the proposed facility in accordance with applicable regulations.

The proposed facility is expected to generate small volumes of maintenance-related hazardous wastes. All hazardous wastes would be managed in accordance with state and federal hazardous waste regulations. No hazardous waste would be treated or disposed of onsite, therefore, a state hazardous waste permit would not be required. Since management of hazardous waste would be in accordance with state and federal hazardous waste regulations and small volumes of hazardous waste are expected to be generated during operation of the proposed facility, no impacts from hazardous or toxic materials are anticipated.

5.13.4 Waste Management Impacts from the Proposed Action

The Proposed Action consists of the construction and operation of the gasification island, power island, and transmission line. It is anticipated that the volume of waste generated from construction of the Proposed Action would be greater since there are more facilities associated with this action. Wastes generated during construction and operation of the power island would be similar to those under No Action Alternative 2 and managed accordingly. KPE would be subject to the same regulations as discussed under No Action Alternative 2.

Some solid waste in the form of dust fines could be generated in the storage and handling of coal and RDF. However, the RDF pellets and coal would be shipped to the site in covered or closed containers and unloaded using a covered conveyor system. Dust control measures would be an integral part of the unloading and handling system. Coal and RDF fines would be injected into the gasification process, thereby avoiding separate handling. In addition, unconverted fines and light ash materials from the raw syngas would be removed using wet scrubbers and reinjected into the gasifier. Therefore, this waste stream is expected to be minimal. The wastes associated with the power facility would be the same as those under No Action Alternative 2.

The Kentucky Pioneer IGCC Demonstration Project is inherently a waste minimization facility. The facility would minimize waste by converting inert ash (primarily coal and RDF) from the gasification process into vitrified frit, a glassy silica matrix material, and hydrogen sulfide from the sulfur recovery process to

elemental sulfur. Operation of the gasification component of the Proposed Action would generate vitrified frit from the quenching of molten slag and elemental sulfur. Frit and recovered elemental sulfur are not waste streams; rather, they are considered commercial products. Frit, which consists of all the inorganic materials from the feed, is nonleachable by EPA standards and thus nonhazardous (Schulz 2000; Nagl 2002). Analysis of gasification processes have found that the slag is not a good substrate for binding organic compounds so it is usually found to be nonhazardous, exhibiting none of the characteristics of hazardous waste. Also, because the slag is in a fused, vitrified state, it rarely fails Toxicity Characteristic Leachate Procedure (TCLP) for metals (DOE 2000). KPE expects the frit to not only pass the TCLP criteria but also the more rigorous TCLP Universal Treatment Standard criteria.

The vitrified frit produced by the gasification process would be marketable. However, if some portion of the frit is not readily sold, it would be stored temporarily in covered railcars and/or disposed of at a permitted industrial solid waste disposal facility as necessary. Recovered sulfur from the gasification process would also be sold.

Even though water, injected as steam in the gasification process, would be heavily reused and condensed oils and tar would be refluxed to the gasifier, a small portion of the water used in cooling and cleaning the syngas would be purged from the system to avoid the accumulation of dissolved salts. This process wastewater as well as sanitary wastewater and stormwater would be treated in the plant wastewater treatment system. Treated wastewater would be discharged to the Kentucky River in accordance with the site-specific KPDES permit. Solid waste (sludge) from the wastewater treatment, primarily treated salts, is expected to be nonhazardous. However, operation procedures would ensure that all wastes are appropriately tested and disposed of in an approved landfill. The wastewater treatment process would not include a sedimentation pond.

There would be no waste streams associated with the air separation process of the Proposed Action.

5.14 Cumulative Impacts

5.14.1 Definition of Cumulative Impacts and Methods of Analysis

5.14.1.1 Cumulative Impacts Definition

Evidence is increasing that the most significant environmental effects may not result from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time (CEQ 1997). The Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA define cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions" (40 CFR 1508.7). The regulations further explain "cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."

5.14.1.2 Method of Analysis

The cumulative impacts analysis qualitatively presented in this document is based on the potential effects of the Kentucky Pioneer IGCC Demonstration Project when added to similar impacts from other projects in the region. An inherent part of the cumulative effects analysis is the uncertainty surrounding actions that have not yet been fully developed. The CEQ regulations provide for the inclusion of uncertainties in the EIS analysis and state that "when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking" (40 CFR 1502.22). The CEQ regulations do not state that the analysis cannot be performed if the information is lacking. Consequently, the analysis contained in this section includes what could be reasonably anticipated to occur given the uncertainty created by the lack of detailed investigations to support all cause and effect linkages that may result from the proposed project, and the indirect effects related to construction and long-term operation of the facility.

In the previous resource descriptions and impacts analysis, Chapter 4, Affected Environment, and Chapter 5, Environmental Impacts, the potential environmental effects of No Action Alternative 2 and Proposed Action were evaluated with respect to existing conditions or "background." This takes into account past actions within and in the vicinity of the Kentucky Pioneer IGCC Demonstration Project. Therefore, discussions in this section will center on the potential effects of recently completed and reasonably foreseeable future actions in the ROIs. Because cumulative impacts accrue to resources, it is important that the analysis of impacts focus on specific resources or impact areas as opposed to merely aggregating all of the actions occurring in and around the proposed project and attempting to form some conclusions regarding the effects of the many unrelated actions. Narrowing the scope of the analysis to resources where there is a likelihood of reasonably foreseeable impacts accruing supports the intent of the NEPA process which is "to reduce paperwork and the accumulation of extraneous background data; and to emphasize real environmental issues and alternatives"(40 CFR 1500.2[b]). Each resource analyzed has its own geographic boundary and the timeframe is assumed to equal the 20-year life expectancy of the proposed project.

The following existing and proposed facilities, operations, and activities may add to the potential cumulative impact of the proposed project:

1. EKPC owns and operates three 80 MW gas turbines 0.8 kilometers (0.5 miles) west of the proposed site. Transmission lines are associated with these turbines. A fourth 80 MW unit is currently under construction. Each of these units are peaker units and only operate for limited timeframes during periods of peak electricity demand.

2. EKPC is proposing to install and operate an additional (fifth unit) 80 MW unit near the site of the proposed project. Associated with this unit is a proposed 138-kV electric transmission line. The new transmission line is approximately 19.3 kilometers (12 miles) in length and will require a 30 to 45 meter (100 to 150 foot) wide right-of-way. The proposed route for the electric transmission line extends from EKPC's J.K. Smith Plant in a southwesterly direction paralleling an existing electrical transmission line for approximately 4.8 kilometers (3 miles) when it then turns more southerly to connect to an existing electric substation in Madison County, Kentucky. EKPC has indicated that two more 80 MW units may also be installed at this site in the near future. These facilities would also be peaker units.

3. As discussed in Chapter 3, the low margin of transmission capacity upon completion of the proposed project, as well as the addition of up to four new 80 MW units near the site, would trigger the need for further expansion of the transmission system in the near future. Based on recent system expansions completed in the area, it is expected that EKPC would install additional transmission lines from the J.K. Smith Site to each of the following locations; the Spencer Road Substation in Montgomery County; the Avon Substation in Fayette County; and the Lake Reba Substation in Madison County. EKPC has indicated that a new 345-kV transmission line may be built from the J.K. Smith Site to the Avon Substation soon after the proposed project is completed. Design plans have yet to be developed for any additional transmission lines. Other possible, though less likely, system expansions within the 20-year life span of this project include transmission lines from the J.K. Smith Site to each of the following locations; the Stanton Substation in Powell County, the Maggard Substation in Maggoffin County, and the Brodhead Substation in Rockcastle County.

4. The population projections for the years 2000 through 2010 indicate that in the socioeconomic ROI, comprised of Clark, Fayette, and Madison Counties, population will continue to grow, increasing by approximately 4.4 percent.

5.14.2 Summary of Potential Cumulative Impacts

The following resource analysis indicates that future potential cumulative impacts contributed to by the Kentucky Pioneer IGCC Demonstration Project are additive in some resources areas. The proposed project would contribute to the overall economic and population growth in the area. Projections for the years 2000 through 2010 indicate that in the socioeconomic ROI, comprised of Clark, Fayette, and Madison Counties, population will continue to grow, increasing by approximately 4.4 percent during the period. Therefore, pressure will continue to be exerted on all resource areas. The 20-year operation period for the Kentucky Pioneer IGCC Demonstration Project would require approximately 120 workers who are expected to reside in the ROI. This will provide additional employment opportunities within the local area and would indirectly contribute to the creation of an additional 270 jobs in the ROI.

The ROI for cumulative effects to aesthetic and scenic resources is the viewshed, which is the broad area that would be able to view the Kentucky Pioneer IGCC Demonstration Project facilities and the associated electrical transmission line. The viewshed area is determined largely by topographic and distance constraints. The Kentucky Pioneer IGCC Demonstration Project would have an aesthetic and scenic cumulative impact. The J.K. Smith Site currently contains three 80 MW CTs, with a fourth unit currently under construction, approximately 0.8 kilometers (0.5 miles) west of the proposed project site. Cumulative visual impacts would occur with the addition of the proposed facility and the other reasonably foreseeable projects discussed previously. The site would appear as more of an industrial type setting with the dominant feature being the Kentucky Pioneer IGCC Demonstration Project's gasifier facilities. The construction of three more 80 MW CTs near the three existing CTs and the addition of increased transmission capacity in the form of transmission lines would drastically change the proposed site's appearance. The dominant visual features of the project, the two gasifier facility stacks, would be seen as far away as Winchester, which is 13.4 kilometers (8.3 miles) to the northeast. Other construction in the area of the plant would also present

a cumulative impact to visual resources, though no reasonably foreseeable projects contain a feature as dominant as the gasifier stacks associated with the Proposed Action.

The Kentucky Pioneer IGCC Demonstration Project would permanently remove the approximately 4.8 hectares (12 acres) of land required for the facility from other uses while the facility is in use. The construction of other CTs by EKPC near the site would also require the allocation of land for the structures, removing further tracts from other use. Based on the construction of other CT units at the J.K. Smith Site, each new CT unit foundation would require an area of approximately 6.1 meters (20 feet) by 30.5 meters (100 feet). Transmission lines near the facility have a typical right-of-way of 30.5 to 45.7 meters (100 to 150 feet) and each new transmission line constructed would require a similarly sized right-of-way. The reasonably foreseeable cumulative impacts to land use would be dependent upon the amount of development at the J.K. Smith Site, but the general result would be that more land would be required for facility and electrical generation development. The amount of development at the J.K. Smith Site should not present a concern to other potential uses of the land as the entire 1,263 hectare (3,120 acre) site is privately owned by EKPC. Future cumulative impacts to soils would come from further disturbances due to the construction and operation of the aforementioned reasonably foreseeable facilities; however, this also is not a concern as the entire J.K. Smith Site was disturbed during the initial phases of the discontinued J.K. Smith Power Station development in the early 1980s.

The cumulative land use impacts would also impact ecological resources within the region. The amount of land lost due to development is equivalent to the amount of vegetation and habitat lost to species in the area. All impacts to ecological resources would be additive and would increase with potential future development. Pressures to find new food sources and habitats will increase as species lose more habitat to development in the region. The competition for the remaining habitat would increase as more facilities and transmission lines are constructed throughout the J.K. Smith Site. Thermal plume effects could include mortality of benthic organisms in the local area of the discharge port. Subsequently, a shift in species populations or lack of recolonization of the affected location could result. Should this occur, the result would be cumulative with the impacts generated by other thermal plume discharges within the Kentucky River.

The three CTs currently present within the boundaries of the J.K. Smith Site withdraw water from the Kentucky River at a rate of 1.8 MLD (468,000 gallons per day) during operation. As stated before, these units only operate for brief timeframes during periods of peak system demand, therefore they are not withdrawing water from the Kentucky River on a continual basis. The fourth CT unit, currently under construction, and the proposed fifth CT unit would also operate during peak demand periods and would each withdraw water from the Kentucky River at a rate of approximately 547,000 liters per day (144,000 gallons per day) of full operation. The potential sixth and seventh CTs would most likely have water withdrawal rates similar to those of the fourth and fifth units. The proposed Kentucky Pioneer IGCC Demonstration Project would withdraw 15.2 MLD (4 MGD) from the Kentucky River on a continual basis. The cumulative withdrawal from the Kentucky Pioneer IGCC Demonstration Project facilities and all seven existing and reasonably foreseeable CTs operating at full capacity would be approximately 19.2 MLD (5 MGD) of operation. The average daily flow of the Kentucky River is calculated at 12.9 billion liters per day (3.4 billion gallons per day) near the water intake fixture for all facilities on the J.K. Smith Site. The cumulative withdrawal of all facilities operating full-time at the J.K. Smith Site would be less than 0.15 percent of the average flow of the Kentucky River and would have little impact on water levels within the river itself. No wastewater data is currently available for the existing, proposed, and reasonably foreseeable CT units. Any wastewater generated by these peaker units, however, would be in limited quantities for brief periods of time and would be treated in a similar fashion as wastewater generated by the Kentucky Pioneer IGCC Demonstration Project facility. Cumulative wastewater emissions from the entire J.K. Smith Site would be nearly equivalent to the levels presented in Section 5.8.

The future growth of the region would also contribute cumulative impacts to water resources. The population for the socioeconomic ROI is expected to grow by approximately 4.4 percent, or 15,000 individuals, over the next 10 years. Additional water would be withdrawn from and additional treated wastewater discharged to the Kentucky River to provide resources for the growing population within the

ROI. Though the exact levels of withdrawal and discharge are not presently known, the additional use of water in the Kentucky River would increase the overall cumulative impact to water resources in the project area.

EKPC currently operates three 80 MW CTs at a site adjacent to the Kentucky Pioneer IGCC Demonstration Project site. A fourth CT is under construction at that site, and a proposed fifth CT is in the project approval stage. All CTs operate as peaking units using natural gas as the primary fuel and fuel oil as a backup fuel. At present, the existing CTs operate for about 500 hours per year. Emissions from each CT are estimated to be 5 kilograms (11 pounds) per hour for reactive organic gases (ROG), 54.5 kilograms (120.2 pounds) per hour for NO_x, 27.3 kilograms (60.1 pounds) per hour for CO, 15.47 kilograms (34.1 pounds) per hour for SO_x, and 205 kilograms (5.5 pounds) per hour for PM_{10}. If seven peaking CT units are eventually constructed at the EKPC site and were to operate concurrently, their emissions would be 35 kilograms (77 pounds) per hour for ROG, 381.7 kilograms (841.4 pounds) per hour for NO_x, 198.8 kilograms (420.7 pounds) per hour for CO, 108 kilograms (238.5 pounds) per hour for SO_x, and 13 kilograms (28.5 pounds) per hour for PM_{10}. By comparison, emissions from the proposed Kentucky Pioneer IGCC Demonstration Project are estimated to be 6.6 kilograms (14.6 pounds) per hour for ROG, 111.7 kilograms (246.2 pounds) per hour for NO_x, 81.7 kilograms (180.1 pounds) per hour for CO, 51 kilograms (112.5 pounds) per hour for SO_x, and 22.4 kilograms (49.4 pounds) per hour for PM_{10}.

During hours of concurrent operation for the seven EKPC peaking CT units and the Kentucky Pioneer IGCC Demonstration Project, cumulative power plant emissions from the J.K. Smith Site area would increase by the following percentages compared to emissions from the proposed project alone: 14 percent for ROG, 342 percent for NO_x, 234 percent for CO, 212 percent for SO_x, and 11 percent for PM_{10}. The dispersion modeling analysis for the Kentucky Pioneer IGCC Demonstration Project (Table 5.7-3) showed that maximum downwind pollutant concentrations from the proposed project would be less than 3.25 percent of the relevant state and federal ambient air quality standards. In most cases, the maximum pollutant concentrations are less than 1 percent of the relevant standards. Even year-round continuous operation of the seven EKPC peaking CT units in combination with the proposed project would not increase cumulative maximum modeled pollutant concentrations to increments of more then a few percent of the relevant state and federal ambient air quality standards.

The majority of the workforce for the construction and operation of the Kentucky Pioneer IGCC Demonstration Project is expected to reside within the three-county ROI established in Section 4.3. The construction workforce for all other reasonably foreseeable projects near the project site would also reside within this ROI. The construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility, as well as the construction of the proposed fifth and potential sixth and seventh CT units and all potential transmission lines would increase traffic on the roadways throughout the ROI. The jobs indirectly created by these projects and the growing population in the ROI would lead to more vehicle trips taken per day throughout the ROI. Cumulative impacts to traffic and transportation may occur throughout the ROI in the form of minor increases in traffic congestion, especially during rush-hour time periods.

In response to *Kentucky Executive Order 2001-771: Relating to the Establishment of a Moratorium on Permits for New Power Plants*, the Kentucky Natural Resources and Environmental Protection Cabinet issued *A Cumulative Assessment of the Environmental Impacts Caused by Kentucky Electric Generating Units* on December 17, 2001. The report addresses the potential cumulative impacts of 22 recently permitted plants, including the Kentucky Pioneer IGCC Demonstration Project, in addition to the 34 electric generating units currently in operation in Kentucky. The analysis presented in the report draws similar conclusions to those presented throughout this EIS, though the conclusions are not as exhaustive as those discussed in this document. The report also includes a number of recommendations regarding state environmental regulations that, if implemented, would mitigate many of the cumulative impacts from power plants throughout the state.

The cumulative lifetime cancer risk from the Proposed Action and current and future actions is based on the incremental risks from the Kentucky Pioneer IGCC Demonstration Project and the operation of seven peaking CT units at the J.K. Smith Site. In estimating the cancer risk associated with the seven peaking CT

units at the site, it was assumed that each unit would be operated for a maximum of 2,500 hours per year. For the Proposed Action, most of that risk is attributable to potential dioxin/furan exposure (which may be over estimated by the extrapolation procedures used in the analysis). As a result, these incremental cancer risks are very conservative estimates based on continuous exposure to hazardous pollutant emissions for 70 years at the location of maximum annual average downwind impact, which is within the boundaries of the J.K. Smith Site. Table 5.14-1 contains the annual emissions and lifetime cancer risk for the three operation scenarios. No data were available for estimating dioxin/furan emissions for the peaking units and there is no basis for making either direction emission estimates or extrapolations from the Kentucky Pioneer IGCC Demonstration Project data. The contribution of dioxin/furan emissions would have resulted in an increased lifetime cancer risk from this source. However, the assumptions and the level of conservatism included in the modeling analysis probably account for the lack of data on dioxin/furans. Even at 2,500 hours of operation of the seven CT units, the additional cancer risk contribution would be small. Cumulative estimated lifetime exposure risk for the Proposed Action and current and future actions is approximately the same risk estimated for the Proposed Action (5.0E-05). Cumulative lifetime cancer risk for off-site locations would be much less than (5.0E-05) and further decrease with distance from the proposed project area.

Table 5.14-1. Lifetime Cancer Risk for Maximum Hazardous Air Pollutant Concentrations from EKPC Units

Hazardous Air Pollutant	**Annual Emissions (tons per year)**			**Estimated Maximum Annual Average Concentration (micrograms/cubic meter) if each EKPC Unit is operated for**			**Lifetime Cancer Risk (chances per million) at locations of maximum impact if each EKPC unit is operated for**		
	500 hours per year	*1,500 hours per year*	*2,500 hours per year*	*500 hours per year*	*1,500 hours per year*	*2,500 hours per year*	*500 hours per year*	*1,500 hours per year*	*2,500 hours per year*
Arsenic	0.0014	0.0041	0.0069	4.75E-06	1.43E-05	2.38E-05	0.001167	0.003501	0.005835
Benzene	0.0204	0.0613	0.1022	1.37E-05	4.11E-05	6.85E-05	0.000041	0.00124	0.000207
Beryllium	0.0000	0.0001	0.0002	1.34E-07	4.02E-07	6.70E-07	0.000018	0.000055	0.000092
Cadmium	0.0006	0.0018	0.0030	1.65E-06	4.95E-06	8.25E-06	0.001130	0.003391	0.005652
Chromium	0.0014	0.0041	0.0069	4.67E-06	1.40E-05	2.34E-05	0.040008	0.120025	0.200041
Formaldehyde	0.8366	2.5099	4.1831	5.64E-04	1.69E-03	2.82E-03	0.000419	0.001257	0.002094
Lead	0.0018	0.0053	0.0088	6.88E-06	2.06E-05	3.44E-05	0.000031	0.000094	0.000157
Manganese	0.0991	0.2973	0.4955	3.52E-04	1.06E-03	1.76E-03	NA	NA	NA
Mercury	0.0002	0.0005	0.0008	5.89E-07	1.77E-06	2.95E-06	NA	NA	NA
Nickel	0.0006	0.0017	0.0029	1.98E-06	5.94E-06	9.89E-06	0.000029	0.000088	0.00147
Selenium	0.0031	0.0094	0.0157	1.03E-05	3.09E-05	5.16E-05	0.000082	0.000247	0.000412
MAXIMUM CUMULATIVE INDIVIDUAL LIFETIME CANCER RISK (chances per million):							**0.042927**	**0.128782**	**0.21437**

Note:
[1] Annual emissions for the EKPC units estimated from AP-42, Chapter 3.1 data
[2] Emission estimates assume a mix of 90% natural gas and 10% fuel oil on a heat input basis. Estimated heat input rate of 717 MMBTU/hr per unit, combined heat input rate of 5,017 MMBTU/hr, typical rating per unit of 80 MW.
[3] Maximum downwind annual average pollutant concentrations scaled from the modeling analysis of the Kentucky Pioneer IGCC Demonstration Project facility.
[4] No data available for estimating dioxin/furan emissions for the peaking units and there is no basis for making either direction emission estimates or extrapolations from the Kentucky Pioneer IGCC Demonstration Project data.
[5] Lifetime cancer risk estimates assume 70 years of exposure at the location of maximum downwind concentration.

5.15 Unavoidable Adverse Impacts

This section summarizes potential unavoidable adverse environmental effects associated with the activities analyzed in this EIS. Unavoidable impacts are those that would occur after implementation of all feasible mitigation measures. For this EIS, such impacts were identified for cultural resources, aesthetic and scenic resources, water resources, ecological resources, and traffic and transportation.

5.15.1 Cultural Resources

The Proposed Action involves the construction and operation of the Kentucky Pioneer IGCC Demonstration Project facility, a project that would affect approximately 121-hectares (300-acres) within the J.K. Smith Site. Because of previous cultural resource investigations and site disturbance, impacts to cultural resources appear to be negligible. However, a potential for subsurface discoveries of cultural materials always exists.

Ground disturbance has the potential to affect archaeological, traditional, and paleontological sites located beneath recent sediments. Alteration in the setting of a traditional, archaeological, or historic resource through the introduction of additional noise, pollution, contamination or lighting may adversely affect archaeological, historic, and traditional resources located within the project's Area of Potential Effect.

5.15.2 Aesthetic and Scenic Resources

Construction of the Kentucky Pioneer IGCC Demonstration Project facility would result in ground disturbance and a change in the visual setting at the site. The facility stacks would be visible from the city of Winchester, over 13 kilometers (8.1 miles) from the project site. Soil erosion could occur during the construction of the facility, as well as the release of fugitive dust particles that might temporarily affect visibility in localized areas. However, erosion and dust control measures would be implemented to minimize impacts.

5.15.3 Water Resources

As a result of construction and operation, minor unavoidable adverse impacts would occur because of an increase in water consumption. However, water consumption would be limited by a site-specific permit.

5.15.4 Ecological Resources

The Proposed Action would disturb approximately 121 hectares (300 acres) within the J.K. Smith Site to construct the proposed facility and support infrastructure. The entire project area has been previously disturbed. Because the land and habitat have been previously disturbed within the project boundaries, a negligible impact in biodiversity and wildlife habitat would occur. Construction would have a minor adverse impact on small, less mobile, mammals during project site clearing and mobilization activities. Birds in the project site area would move away from the construction activities to adjacent similar habitat within the J.K. Smith Site or offsite. Impacts from transmission lines on ecological resources will be addressed in a separate NEPA analysis being prepared by the Rural Utility Service. The operation of the proposed facility would increase human presence, night lighting, and noise. Potential exposure to air emissions to plant and animal species within the J.K. Smith Site and in the adjacent surrounding areas may increase due to the operation of the Kentucky Pioneer IGCC Demonstration Project.

5.15.5 Traffic and Transportation

Traffic on area roads around the site would increase as a result of construction and operation due to the additional workers and machinery. Traffic would be heavy at the intersection of Kentucky Highway 89 and the site access road during the construction of the facility. Should raw materials be supplied by trucks, traffic conditions around Trapp would experience adverse impacts due to heavy truck traffic.

5.16 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The construction and operation of the proposed Kentucky Pioneer IGCC Demonstration Project would have an impact on the environment for at least as long as the plant is in operation. The land taken for the project would be lost from future development during the period that the land is used as a power plant.

The proposed plant would be consistent with local, state, and federal plans and permits. These plans are based on planning efforts that recognize the need for orderly growth and power service demands within the context of past, present, and future development. The short-term impacts and use of resources for the proposed plant also would be consistent with the maintenance and enhancement of long-term productivity for the State of Kentucky and the EKPC J.K. Smith Site.

5.17 Irreversible and Irretrievable Commitments of Resources

Implementation of the proposed Kentucky Pioneer IGCC Demonstration Project would involve a commitment of natural, physical, human, and fiscal resources. Land used in the construction of the proposed facility would be considered an irreversible commitment during the time period that the land is used as a power plant. However, if greater need arises for the use of the land or if the plant is no longer needed, the land could be converted to another use. At present, there is no reason to believe such a conversion would be necessary or desirable.

As stated in Section 3.1.1, KPE will not begin detailed design of the proposed project, including layout and flowsheet information, until the project financing is finalized. The applicant has, however, provided rough general estimates of quantities of materials required for the construction of the gasification island facilities. The estimates are as follows: steel - 160,000 tons; concrete - 145,000 tons; pipe - 140,000 tons; and wire - 100,000 tons. These materials would be used for plant construction and are generally considered to be irretrievable. Nonrenewable, and therefore irretrievable, natural resources would also be required for construction; however, the quantity of material has yet to be determined. The construction of the facility would require the employment of 600 workers during average periods and as many as 1,000 workers during peak periods. This use of labor is also considered a commitment of irretrievable resources, as these workers would not be able to work in other capacities while employed on the construction site. The only one of these resources considered to be in short supply in the region is labor, given the relatively low unemployment rate of 2.2 percent. As discussed in Section 5.3, this limitation would be overcome by the temporary nature of construction work itself and the addition of new labor to the regional supply, both through individuals becoming an age in which they are eligible for work and an influx of individuals to the ROI. Construction also would require a substantial one-time expenditure of federal funds as part of the Clean Coal Technology Program, which are retrievable by a repayment plan based on future licensing and commercialization of the demonstrated technologies.

Operation of the facility would also require a commitment of irretrievable resources in the form of the gasifier feeds and labor. The gasifier requires feeds of 2,268 metric tons (2,500 tons) per day each of coal and RDF pellets and 127 metric tons (140 tons) per day of limestone, all of which would be irretrievable once the syngas has been created. The waste products from the gasification, including the sulfur, frit, and ash, would be marketable and would introduce a new resource to the region. The labor commitment would be 120 workers for the 20-year operational life expectancy of the facility. Though labor is in limited supply, it is expected that these 120 jobs would be filled by available labor resources within the ROI. The raw materials required to feed the gasification unit are not considered to be in short supply and their use would not have an adverse effect on the operation of the facility.

The commitment of these resources is based on the concept that businesses, residents of the service area, commercial users of power, and the federal government would benefit from the improved quality of service associated with the new plant. These benefits would consist of improved service to meet existing and proposed demands, the results of the demonstration phase for burning coal cleanly, and a greater availability of quality services, which are anticipated to justify the commitment of these resources.

5.18 Mitigation

An overview of planned mitigation measures for the proposed activities outlined in this EIS is presented below. These measures address both direct and indirect impacts to the environment from the construction and operation of the Kentucky Pioneer IGCC Demonstration Project that could remain after application of design features and operating practices required by permits. Mitigation measures for resources not discussed in this section have been determined to be unnecessary.

5.18.1 Cultural Resources

During construction there is the possibility of encountering deeply buried archaeological resources including human remains. To minimize the potential adverse effects to unanticipated discoveries during construction, basic information will be provided to workers involved in ground disturbing activities regarding the recognition of archaeological resources and Native American cultural items and the procedures to be followed upon discovery. The construction contractor will be required to assure that discovery procedures are implemented in all applicable cases. These procedures address the responsibilities under 36 CFR 800.13, 43 CFR 10.4, Section 3(d)(1) of the *Native American Graves Protection and Repatriation Act* (NAGPRA) and the State of Kentucky historic preservation and burial laws. Discovery procedures are summarized below, but should be addressed in detail in the SHPO consultation.

Should human remains be discovered, the local coroner and law enforcement agency must be notified immediately. If the burials are identified as being Native American, NAGPRA regulations may be applicable and DOE should be notified. Immediately after the discovery, construction in the area will cease. An evaluation will be made by a qualified archaeologist regarding the extent of the construction exclusion zone. Construction will not resume in the area until directed by the archaeologist. In compliance with applicable state and federal laws, notification of other agencies, Native American groups and/or the SHPO may be required prior to removal and for a determination of the party that has a legitimate claim to the remains.

In the event that archaeological resources are discovered after the project has begun, a qualified archaeologist will be notified and all construction in the vicinity of the discovery will cease. An evaluation will be made regarding the extent of the construction exclusion zone and construction will not resume in the area until directed by the archaeologist. DOE and the SHPO will be notified. For expediency's sake, the newly discovered property will be considered eligible for the NRHP (as stipulated in 36 CFR 800.13[c]) and a treatment plan will be developed to mitigate any adverse effects. However, if the property is clearly ineligible, and there is agreement with this determination by the representative of DOE and the SHPO, the property will be considered not eligible and would not be subject to further consideration.

5.18.2 Aesthetic and Scenic Resources

Short-term visibility impacts from fugitive dust during construction activities would be minimized using standard dust control measures such as watering.

5.18.3 Geology

Potential soil erosion in the areas of ground disturbance would be mitigated through minimizing areas of surface disturbance and by utilizing construction engineering measures in accordance with permit requirements. Additional mitigation is not anticipated to be necessary.

5.18.4 Air Resources

Emission control requirements (equipment design requirements and operational procedures requirements) for the proposed project will be established by the Kentucky Division for Air Quality and the EPA as part of the PSD Permit Approval process. Emission controls proposed as part of the PSD Permit

Application include enclosed storage of raw materials; fabric filters on limestone storage silos; covered conveyors for raw material transfer; drift eliminators on the cooling tower; and steam injection or other combustion controls on the gas turbines. During construction activities, fugitive dust would be minimized using standard dust control measures such as watering. Covered railcars should also be implemented to minimize fugitive dust from coal and RDF pellet transport to the site.

5.18.5 Water Resources and Water Quality

Potential water resources and water quality impacts would be minimized by pretreatment in a new wastewater treatment facility and by the issuance of permits for compliance with water usage and wastewater discharge. These federal- and state-issued permits would specify site-specific criteria to be met to minimize potential impacts. The facility would be designed to minimize water usage, and any discharges would have to comply with national and state wastewater and stormwater discharge permits. Therefore, no additional mitigation measures are anticipated to be necessary. KPE will cease water withdrawals if drought conditions warrant or if requested by the state.

5.18.6 Ecological Resources

Post-construction mitigation landscaping would consist of a control program for nonnative invasive plant species such as nonnative thistles, fescue, and mustard. The site would be revegetated with a blend of native grasses and forbs. Grasses could include Big Bluestem, Indian Grass, or Switchgrass and forbs such as Blazing Star, Purple Coneflower and Cardinal Flower. Due to the height of the emissions stacks, the Federal Aviation Administration will require stack lighting. To minimize bird strike mortality, the USFWS has developed a set of voluntary recommendations for tower siting, construction, operation, and decommissioning. The gasifier stacks lighting system would be designed in consideration of USFWS recommendations.

5.18.7 Noise

Mitigation measures necessary to minimize noise impacts would be implemented. Buildings housing the gas turbine units should be designed to ensure a substantial reduction in noise transmitted to the outside. A reduction of gas turbine noise to 95 dBA or less, adjacent to the outside of the building, should be considered as a basic design requirement. In addition, the building housing the gasifiers should be designed to ensure a significant reduction in noise transmitted to the outside. A reduction of gasifier noise to 65 dBA or less, adjacent to the outside of the building, would be considered a basic design requirement.

5.18.8 Traffic and Transportation

The majority of the traffic impacts would be experienced during the construction phase with minor impacts experienced during the operation of the Proposed Action. The main traffic concerns requiring mitigation are the intersection of the site access road and Kentucky Highway 89 and the access road itself. The addition of turning lanes and a traffic signal would assist in regulating traffic flows at the intersection. Any changes to Kentucky Highway 89 should be made in conjunction with the 7th District of the Kentucky Transportation Cabinet. To facilitate traffic in and out of the project site, the access road should be widened to four lanes or directional controls should be implemented. Directional controls refer to having both lanes travel in the same direction during peak usage of the road. Appropriate warning signs should be put in place if this method is adopted. Aside from scheduling rail deliveries in coordination with other main rail line traffic, no mitigation is required for rail transportation.

5.19 Environmental Justice

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 32), this section identifies and addresses any disproportionately high and adverse human health or environmental effects on minority or low-income populations from activities described in previous sections of the EIS.

5.19.1 Methodology

Environmental justice guidance developed by the CEQ defines "minority" as individuals who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997). Minority populations are identified when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population in the surrounding area or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census. The current threshold was defined in 2000 as 1999 income less than $17,463 for a family of four. The threshold applicable for this analysis was defined in 1990 as 1989 income less than $12,674 for a family of four.

Environmental justice impacts become issues of concern if the proposed activities result in disproportionately high and adverse human health and environmental effects to minority or low-income populations. All resource areas analyzed in this EIS have been included in the environmental justice analysis. While impacts from the majority of the resource areas can be measured by proximity to the project, special attention must be given to the effects on human health in local communities. Disproportionately high and adverse human health effects are identified by assessing these three factors to the extent practicable:

- Whether the health effects, which may be measured in risks or rates, are significant (as defined by NEPA) or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.

- Whether the risk or rate of exposure to a minority or low-income population to an environmental hazard is significant (as defined by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.

- Whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

The environmental impacts from any project are highly concentrated at the actual project site and tend to decrease as distance from the project site is increased. Due to this relationship, the environmental justice analysis examines smaller geographic regions around the project site for which statistical data is available. The area analyzed for environmental justice (except for economic environmental justice impacts) has no relation to, nor should be in any way mistaken for the three-county ROI established for the socioeconomic analysis. By nature the economic impacts associated with a project occur over a wider area. See Section 4.3, Socioeconomics, for further discussion.

Data for all statistical categories required for the environmental justice analysis has not been made available from the 2000 Census, therefore, this assessment utilizes counts from the 1990 Census. The 1990 Census data reflects social and economic conditions from 1989, the last full year before the census was taken. Clark County, Kentucky, the location of the proposed facility, was divided into six census tracts during the collection of data in 1990. The proposed facility would be located near the center of Census Tract 0204, in the southeastern corner of the county (Figure 5.19-1). Census Tract 0204, which covers 218.3 square kilometers (84.3 square miles), is the smallest geographic region for which demographic data is available. Though the environmental impacts associated with the alternatives analyzed in this EIS would be spread over

larger geographic areas, they would be concentrated in Census Tract 0204. Table 5.19-1 shows the minority and low-income populations for Census Tract 0204 and also presents the data for consecutively larger geographic areas, Clark County, the ROI, and Kentucky, as a comparison.

Table 5.19-1. Comparison of Minority and Low-Income Populations for Geographic Areas Associated with the Proposed Facility

	Census Tract 0204	Clark County	Socioeconomic ROI	Kentucky
White	100.0%	94.0%	87.2%	92.0%
Black	0.0%	5.5%	11.1%	7.1%
American Indian, Eskimo, or Aleut	0.0%	0.3%	0.2%	0.2%
Asian or Pacific Islander	0.0%	0.1%	1.3%	0.5%
Other Race	0.0%	0.1%	0.3%	0.0%
Hispanic	0.0%	0.3%	0.9%	0.6%
Low-Income	19.3%	17.7%	15.9%	19.0%

Note: Persons of Hispanic Ethnicity may be of any race.
Source: Census 1990, Census 1995.

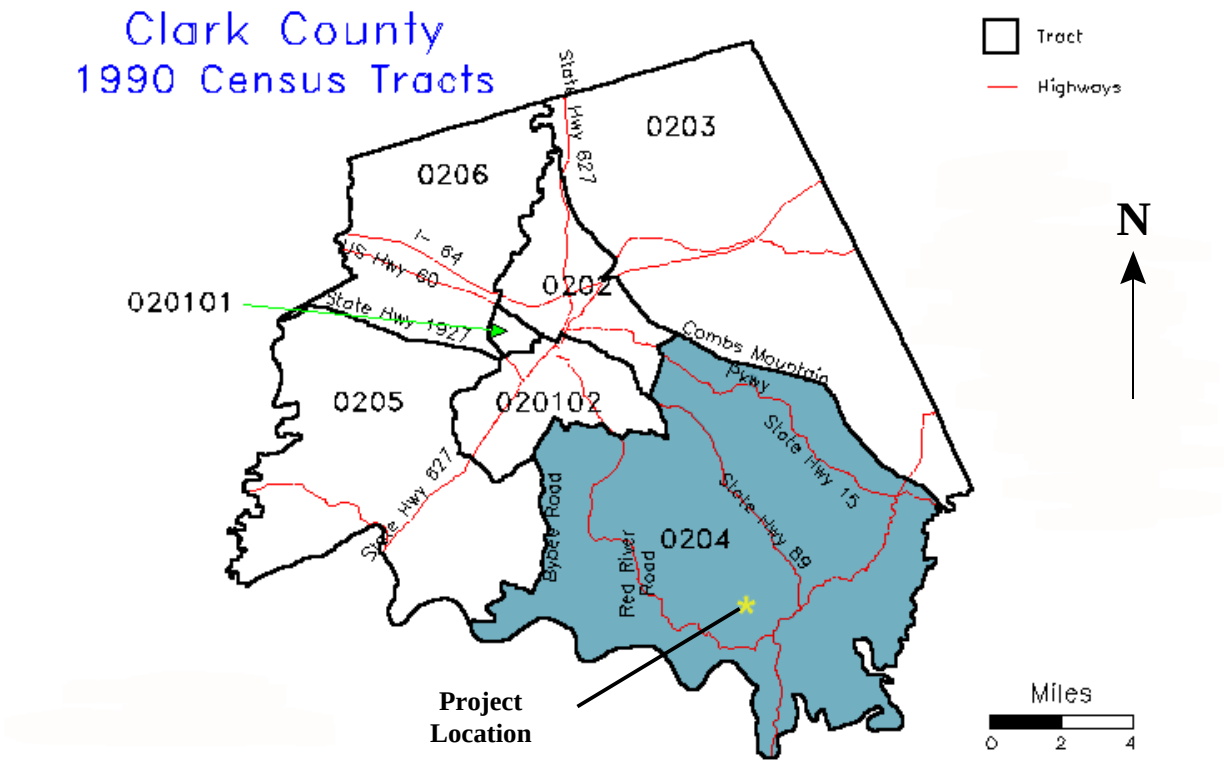
Compared to established national averages, Kentucky has a low minority population throughout the state. Though the Socioeconomic ROI has higher minority populations than the rest of the state, the majority of the minority populations are in Fayette and Madison Counties. Clark County has comparatively fewer minority residents than the rest of Kentucky. The 1990 Census counts for Census Tract 0204, which is the area surrounding the project site, indicates that no members of minority populations live near the project site. The 1990 Census count for Census Tract 0204 shows that all 2,770 residents indicated their race as white (Census 1990). Based on historic population trends in the region, it is expected that the little, if any, change has occurred to the racial composition of Census Tract 0204 in the past decade. Since it is likely that no members of minority populations are present within Census Tract 0204, no environmental impacts would disproportionately affect any minority residents, and no environmental justice issues would occur with respect to members of minority populations.

The national percentage of people considered low-income, which is below the established poverty level, in 1989 was 12.8 percent (Census 2000b). Comparatively, the percentage of Kentuckians considered low-income in 1989 was much higher, at 19.0 percent. The ROI and Clark County had lower rates of low-income individuals than the state; however, they were still significantly higher than the national average. The table indicates that Census Tract 0204, with a rate of 19.3 percent, contains a disproportionately high population of low-income individuals.

By 1995, the national percentage of individuals below the poverty line had increased to 13.8 percent (Census 2000b) while the percentage for Clark County had decreased to 15.3 percent (KDPH 2000). This indicates that the percentage of low-income population in Clark County, though still higher than the national average, is becoming more in line with other areas of the country. This trend can be applied to the census tracts comprising Clark County. Though data is not available for Census Tract 0204 for 1995, a low-income percentage of 16.8 percent can be inferred based on the available county data (KDPH 2000; Tracts 1990).

5.19.2 Environmental Justice Impacts from No Action Alternative 1

Under No Action Alternative 1, DOE would not provide cost-shared funding for the proposed project and no new facilities would be constructed at the proposed project site. Therefore, no disproportionately high or adverse human health effects would be generated and, thus, no environmental justice issues would result.



Source: Louisville 2001.

Figure 5.19-1. Clark County Census Tracts, 1990

5.19.3 Environmental Justice Impacts from No Action Alternative 2

Under No Action Alternative 2, DOE would not provide cost-shared funding for the proposed project; however, KPE, would construct and operate the power island and all associated facilities with a natural gas feed. As shown in the respective resource analyses contained in this chapter, including Occupational Health and Public Safety, no high or adverse human health or environmental impacts would be experienced at or outside the project site under this alternative. Therefore, no environmental justice concerns are raised by this alternative.

5.19.4 Environmental Justice Impacts from the Proposed Action

Under the Proposed Action, DOE would provide cost-shared funding for the design, construction, and operation of the Kentucky Pioneer IGCC Demonstration Project and all associated facilities. As shown in the respective resource analyses contained in this chapter, including Occupational Health and Public Safety, no high or adverse human health or environmental impacts would be experienced at or outside the project site under this alternative. Therefore, no environmental justice concerns are raised by this alternative.

6. STATUTES, REGULATIONS, CONSULTATIONS, AND OTHER REQUIREMENTS

6.1 Statutes and Regulations

This section identifies and summarizes the major federal, state, and local laws, regulations, and requirements that may apply to the alternatives analyzed in this Environmental Impact Statement (EIS).

6.1.1 Federal Environmental Statutes and Regulations

***National Environmental Policy Act* of 1969 (NEPA), as amended (42 United States Code [USC] §4321 et seq.), the Council on Environmental Quality Implementing Regulations (40 Code of Federal Regulations [CFR] § 1500 et seq.) and DOE Implementing Regulations (10 CFR §1021 et seq.)** This EIS is being prepared to comply with NEPA, the federal law that requires agencies of the federal government to study the possible environmental impacts of major federal actions significantly affecting the quality of the human environment.

***Clean Air Act* (CAA), as amended (42 USC §7401 et seq.)** The CAA establishes National Ambient Air Quality Standards (NAAQS) set by the U.S. Environmental Protection Agency (EPA) for certain pervasive pollutants. The standards are set at a level designed to protect human health with a conservative margin of safety. The CAA contains emission limiting programs and permit programs to protect NAAQS and air quality. Regulations implementing the CAA are found in 40 CFR Parts 50-95. The New Source Performance Standards establish requirements for new or modified sources such as design standards, equipment standards, work practices, or operational standards. Title IV of the CAA regulates acid deposition by establishing limitations on sulfur dioxide and nitrogen oxide emissions, permitting requirements, monitoring programs, and record keeping and reporting requirements for emission sources. The National Emission Standards for Hazardous Air Pollutants program regulates emission levels of carcinogenic or mutagenic pollutants for certain sources.

Under the CAA, a new major source is required to obtain a Prevention of Significant Deterioration (PSD) Construction Permit and a Title V Operating Permit. The State of Kentucky has been delegated authority by EPA to issue these permits to assure compliance with all CAA requirements. Kentucky Pioneer Energy, LLC, (KPE), has prepared an application for a PSD Permit for the proposed project.

***Clean Water Act* (CWA) of 1977 as amended (33 USC §1251 et seq.)** The CWA focuses on improving the quality of water resources by providing a comprehensive framework of standards, technical tools, and financial assistance to address the many causes of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction. Under provisions of the CWA, an applicant for a federal license or permit to conduct any activity that may result in a discharge to navigable waters must provide the federal agency with a Section 401 certification. The certification, made by the state in which the discharge originates, declares that the discharge will comply with applicable provisions of the CWA, including water quality standards requirements. Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills for development, water resource projects, infrastructure development, and conversion of wetlands to uplands for farming and forestry. A federal permit is required to discharge dredged or fill material into wetlands and other waters.

***Resource Conservation and Recovery Act* (RCRA), as amended (42 USC §6901 et seq.)** RCRA regulates the treatment, storage, and disposal of hazardous wastes. The plant is expected to generate small volumes of hazardous maintenance related waste, and would be a conditionally exempt small quantity generator under federal and state hazardous waste regulations. The plant would obtain a generator identification number and would temporarily store small volumes of wastes onsite in secure containers prior

to transport offsite to an authorized treatment, storage, recycling, or disposal facility. The plant would not treat or dispose of hazardous wastes onsite, so a state hazardous waste permit would not be required. KPE will need to determine whether vitrified frit would be a hazardous waste under RCRA by performing the Toxicity Characteristic Leaching Procedure on the first batch of frit produced by the facility.

***Emergency Planning and Community Right-to-Know Act* of 1986 (EPCRA) (42 USC §11001 et seq.)** This statute requires that inventories of specific chemicals used or stored onsite be reported on a periodic basis. The plant would manufacture, process, or otherwise use a number of substances subject to EPCRA reporting requirements, such as some trace metals and mercury.

***Occupational Safety and Health Act* (OSHA) of 1970, as amended (29 USC §651 et seq.)** Compliance with the OSHA would be required according to OSHA standards. Specifically, the construction and general industry rules in 29 CFR Parts 1910 and 1926 apply. Plant employees would be instructed in worker protection and safety procedures, and would be provided appropriate personal protective equipment pursuant to the plant's safety program.

***National Pollutant Discharge Elimination System* (NPDES) (33 USC 1342 et. seq.)** This federal regulation authorized under the CWA requires sources to obtain permits to discharge effluents (pollutants) and stormwaters to surface waters. Regulations implementing the NPDES program are found in 40 CFR 122. Under this program, permit modifications are required if discharge effluents are altered. The CWA authorizes EPA to delegate permitting, administrative, and enforcement duties to state governments, while EPA retains oversight responsibilities. The State of Kentucky has been delegated NPDES authority and is thus the issuing agency for the NPDES permit. The proposed project involves discharge to surface waters and would be subject to NPDES requirements.

***Compliance With Floodplain/Wetlands Environmental Review Requirements* (10 CFR 1022)** Executive Order 11988, Floodplain Management, directs federal agencies to establish procedures to ensure that they consider and minimize potential effects of flood hazards and floodplain management for any action undertaken. Executive Order 11990, Protection of Wetlands, requires federal agencies to avoid short- and long-term impacts to wetlands if a practical alternative exists. U.S. Department of Energy (DOE) regulation 10 CFR 1022 establishes procedures for compliance with these Executive Orders. Where there is no practical alternative to development in floodplain and wetlands, DOE is required to prepare a floodplain and wetlands assessment discussing the effects on the floodplain and wetlands, and consideration of alternatives. In addition, these regulations require DOE to design or modify its actions to minimize potential damage in floodplains or harm to wetlands and provide opportunity for public review. The proposed project site does not contain any wetlands. The only portion of the proposed project with the potential to affect the 100-year floodplain is the existing water intake. However, this structure is located in the Kentucky River itself and the required modifications would not impact the 100-year floodplain.

***Endangered Species Act* of 1973 (16 USC 1531 et seq.)** Section 7, "Interagency Cooperation," requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. Consequently, the U.S. Fish and Wildlife Service (USFWS) conducts a consultation, in compliance with Subsection (a)(2) of Section 7 of the Act, with regard to the impacts of the proposed project on threatened and endangered species listed by USFWS and any critical habitat of such species in the vicinity of the project. A consultation has been conducted with the USFWS for the proposed project. Discussion of potential impacts on threatened and endangered species from the proposed project is contained in Section 5.9, Ecological Resources, of this EIS.

***Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994)** This Executive Order requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income

populations. Discussion of environmental justice issues for the proposed project is contained in Section 5.19, Environmental Justice, of this EIS.

***National Historic Preservation Act* of 1966, as amended (16 USC 470 et. seq.)** This federal statute requires DOE to consult with the State Historic Preservation Officer (SHPO) prior to construction to ensure that no historical properties would be affected by the proposed project. Consultations with SHPO for the Kentucky Pioneer Integrated Gasification Combined Cycle (IGCC) Demonstration Project have determined that the Section 106 Review process is complete and, in accordance with 36 CFR 800.4(d) of the Advisory Council on Historic Preservation's revised regulations, no effect on historic resources has been found for this project.

***Federal Aviation Act* (FAA) of 1958 (49 USC 1101 et. seq., as amended)** Regulations implementing FAA are found in 14 CFR 77 and are enforced by the U.S. Department of Transportation, FAA. These regulations require submittal of notice identifying any structures which, because of construction or alteration, may be a hazard to air transportation. East Kentucky Power Cooperative would submit FAA Form 7460-1, Notice of Proposed Construction or Alteration, to the FAA.

***Standards of Performance for New Stationary Sources* (40 CFR 60)** Regulations governing the combustion of refuse derived fuel (RDF) pellets, a form of municipal solid waste (MSW), are codified under 40 CFR 60. The definition of municipal waste combustor or municipal waste combustor unit at 40 CFR 60.51b includes "any setting or equipment that combusts solid, liquid, or gasified municipal solid waste . . . The boundaries of a municipal solid waste combustor includes, but is not limited to, the municipal solid waste fuel feed system." EPA defines MSW at 40 CFR 60.51b as household, commercial/retail, and/or institutional waste, including RDF. EPA's regulations contain a conditional exclusion for co-fired combustors. To be eligible for this conditional exclusion, the combustor unit must obtain a federally-enforceable permit limiting the amount of MSW (or RDF) in the fuel feed stream to a maximum of 30 percent of the total weight. During the Kentucky Pioneer IGCC Demonstration Project period, which is the first year of commercial operation of the facility, 50 percent of the solid fuel feed stream by weight would be comprised of RDF pellets. This exceeds the limit established for co-fired combustors, thus, the facility must be permitted as a Municipal Waste Combustor and must meet all environmental requirements established under 40 CFR 60. The air permit notes that the facility is permitted as a Municipal Waste Combustor.

6.1.2 State and Local Environmental Statutes and Regulations

***Kentucky Natural Resources and Environmental Protection Cabinet, Department of Environmental Protection* (Kentucky Revised Statutes [KRS] 224 and 401 Kentucky Admistrative Regulations [KAR])** KRS Chapter 224 details state statutes governing environmental protection and Title 401 KAR outlines the regulations and policies of the Kentucky Natural Resources and Environmental Protection Cabinet, the state agency responsible for monitoring the environment within Kentucky. All state environmental regulations applicable to the Kentucky Pioneer IGCC Demonstration Project are contained within 401 KAR. KPE would ensure that the project complied with all regulations contained within 401 KAR. The following paragraphs detail specific permits applicable to the facility and regulations of particular relevance.

***Construction/Operation Air Permit* (KRS 224.10-100, 224.20-210 and 401KAR 50:038)** The Kentucky Division for Air Quality is responsible for implementing federal and state air quality standards. The State of Kentucky has developed a State Implementation Plan which contains the rules and permitting requirements developed to assure maintenance of the NAAQS. All major sources must file for and obtain a construction/operating permit to fulfill both Kentucky requirements and federal PSD Construction and Title V Operating Permit requirements prior to commencing construction. The Kentucky Department of Air Quality issued the Final PSD/Title V Permit to KPE on June 7, 2001.

***Kentucky Pollutant Discharge Elimination System* (KPDES) *Permitting Program* (KRS 224.16-50 and 401 KAR 5:050-5:080)** The Kentucky Division of Water administers the federal NPDES program. The KPDES program requires permits containing effluent standards for the discharge of pollution into surface waters of Kentucky. The effluent standards and prohibitions in the permits are established under 40 CFR 129 as of July 1, 1991, as published by the Office of the *Federal Register,* for toxic pollutants. KPDES stormwater permits are also required for construction projects that disturb more than 2 hectares (5 acres) of land. Compliance with the KPDES program fulfills a source's requirements under Kentucky's Operating Permits Program pursuant to 401 KAR 5:005. The proposed alternative involves the discharge of wastewater to surface waters and would be subject to KPDES requirements.

***Water Withdrawal Permits; Criteria; Reports* (401 KAR 4:010)** A Water Withdrawal Permit is required to withdraw, divert, or transfer public water from a stream, lake, groundwater source, or other body of water. As stated in Section 5.8.3 of this EIS, EKPC would likely request that their existing withdrawal permit be amended to reflect the additional water required for the project.

***Wild Rivers Utility Right-of-Way Construction Permit* (KRS 146.200, 146.360, and 401 KAR 4:125, Section 11)** A permit is required from the Kentucky Division of Water prior to the construction of any utility lines or pipelines within any portion of a stream area designated as a wild river (maximum of 610 meters [2,000 feet] in either direction from center of stream). Depending upon the routing of the proposed utility right-of-ways, this permit may be required for the proposed project.

***Kentucky Executive Order 2001-771: Relating to the Establishment of a Moratorium on Permits for New Power Plants* (June 19, 2001)** This Executive Order issued by the Governor of Kentucky required Kentucky state agencies to temporarily suspend the acceptance of applications for new electric generating facilities, beginning on June 20, 2001. The Natural Resources Environmental Protection Cabinet and the state Public Service Commission were required to study the cumulative effects of new power plants as well as the impact new plants could have on existing environmental programs. The findings were reported to the Governor on December 17, 2001, and are noted in Section 5.14, Cumulative Impacts. This order does not affect any applications that have already been filed with state agencies. All applications for the Kentucky Pioneer IGCC Demonstration Project were filed prior to the establishment of the moratorium (KOG 2001). *Executive Order 2002-50*, issued January 11, 2002, extended the moratorium on new permits and included an amendment that the moratorium is applicable to all new electrical generating units that did not already obtain all required permits and that had not begun construction. *Executive Order 2002-50* also lifts the ban on the acceptance of new applications for air, water, and waste permits initiated by *Executive Order 2001-771*, but establishes a ban on the issuance of those permits (KRC 2002a). *Executive Order 2002-95*, issued January 23, 2002, clarifies that the ban on the issuing of permits applies for all applications regardless of the date of filing and extends the moratorium on the issuing of permits to July 15, 2002 (KRC 2002b). This moratorium prevents the Kentucky Pioneer IGCC Demonstration Project from commencing construction while it is in effect.

Kentucky Solid Waste, Hazardous Waste and Waste Management Statutes and Regulations (KRS 224.01-010 [20] and [23], 224.40, and 401 KAR 30 through 40) Kentucky state statutes and regulations regarding waste management and waste related issues are detailed in KRS 224.40 and 401 KAR 30 through 40. KRS 224.01-010 (20) and (23) define recovered material and refuse-derived fuel (RDF), respectively. An interpretation of state law has been requested for the RDF used for the project because it would retain plastics and other materials defined under KRS 224.01-010 (20) as recovered material for their heating value. The Kentucky state definition of RDF, under KRS 224.01-010 (23), states that all recovered material must be extracted for recycling. The Kentucky Division of Waste Management has indicated that the RDF pellets would be considered an RDF under KRS 224.01-010 (23) if manufactured as proposed by Global Energy. Furthermore, because the RDF would be a recovered material, the proposed project would be considered a recovered material processing facility and a waste permit would not be required. (See Appendix A, page A-7).

In addition to state regulations, local environmental and zoning regulations may apply to the Kentucky Pioneer IGCC Demonstration Project. Potential Clark County requirements include rezoning, building permit, landscape and tree protection, engineering plan approval, development agreement, and solid waste disposal or management facility certificate.

6.2 Consultations

NEPA requires that, during the preparation of an EIS, DOE consult with all federal agencies with jurisdiction or special expertise in the topics being analyzed in the EIS. In addition, NEPA requires that agencies request comments from state and local agencies that are authorized to develop and enforce environmental standards. Consultations with these agencies, along with consultations with Native American groups, must be conducted regarding the potential for the proposed project to disturb sensitive resources.

The necessary consultations must occur in a timely manner and are generally required before any land disturbance can begin. Most of these consultations are related to biological, cultural, and Native American resources. Biological resource consultations generally pertain to the potential for activities to disturb sensitive species or habitats. Cultural resource consultations pertain to the potential for destruction of important cultural or archaeological sites. Native American consultations are concerned with the potential for disturbance of Native American ancestral sites or traditional practices.

DOE has conducted consultations with various agencies as required by NEPA for the Kentucky Pioneer IGCC Demonstration Project. A consultation was conducted with the USFWS, as required under Section 7 of the *Endangered Species Act* of 1973, with regard to potential impacts of the proposed project on threatened or endangered species. A PSD Permit application for air emissions has been prepared in consultation with the Kentucky Division for Air Quality for the proposed project.

A Section 106 Review process pursuant to the *National Historic Preservation Act* of 1966 has been completed for the proposed project. A previous Section 106 Review process was conducted on the project site in concurrence with the SHPO in December of 1980, as described in Section 4.4.3 of this EIS. The terms of the Memorandum of Agreement drawn up in conjunction with the Advisory Council on Historic Preservation for the old J.K. Smith Power Station project have been met by the Kentucky Pioneer IGCC Demonstration Project. A copy of the letter received from the Kentucky SHPO providing a determination of no effect on historic properties is enclosed, along with all consultation letters received, in Appendix A of this document.

7. LIST OF PREPARERS AND REVIEWERS

This *Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project Environmental Impact Statement* was prepared under the supervision of the U.S. Department of Energy National Energy Technology Laboratory (DOE-NETL). The organizations and individuals who contributed to the preparation of this document are listed below accompanied by each person's project role, level of experience, and training.

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8. GLOSSARY

accident An unplanned sequence of events that results in undesirable consequences.

adsorption The attraction and adhesion of ions or molecules in a gaseous or aqueous state to a solid surface.

air pollutant Any substance, including but not limited to, dust, fumes, gas, mist, odor, smoke, vapor, pollen, soot, carbon, or particulate matter that is regulated.

air quality The general condition of the air resources, usually expressed in terms of attainment of ambient air quality standards.

air quality concentration The specific measurement (or estimate) in the ambient air of a particular air pollutant at any given time.

air quality criteria Regulatory limits of air pollutants in ambient air, designated by varying amounts of pollution and lengths of exposure, designed to limit the potential for specific adverse effects to health and welfare (see air quality standard).

air quality standard The prescribed level of a pollutant in the outside air that cannot be exceeded during a specified time in a specified geographical area. Established by both federal and state governments (see air quality criteria).

ambient air Any unconfined portion of the atmosphere: open air, surrounding air. The portion of the atmosphere outside of buildings to which the general public has access.

attainment area Any area which is designated, pursuant to 42 United States Code (USC) Section 7407(d) of the *Clean Air Act*, as having ambient concentrations of equal to or less than national primary or secondary ambient air quality standards for a particular air pollutant or air pollutants.

baseline A quantitative expression of conditions, costs, schedule, or technical progress which serves as a base or standard for measurement; the established plan against which the status of resources and the progress of a program can be measured.

Best Available Control Technology (BACT) An emission standard (including fuel cleaning or treatment or innovative fuel combination techniques) for control of contaminants required to be included in PSD Permits. BACT shall be determined on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, and shall be at least as stringent as any applicable Sections of 40 *Code of Federal Regulations* (CFR) Part 60 and 40 CFR Part 61. If an emissions standard is infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed as BACT.

calorific A chemistry term relating to heat production.

capacity The maximum load a generator, turbine, power plant, transmission circuit, or power system can supply under specified conditions for a given period of time without exceeding approved limits of temperature and stress.

Clean Coal Technology Program The Clean Coal Technology (CCT) Program was implemented in 1986 to allow for a number of advanced, more efficient, reliable, and environmentally responsive coal utilization and environmental control technologies to become available to the U.S. energy marketplace. The projects under the CCT Program potentially demonstrate cost-effective CCTs that are capable of being commercialized. The CCT

Program's main goal is to achieve significant long-term reductions in sulfur dioxide and nitrogen oxide emissions from coal burning and industrial facilities by providing federal funds for projects that will demonstrate new efficient and environmentally-safe coal technologies.

coal fines Small particles and dust from coal, usually less than 200 mesh.

combined cycle The type of generating plant that burns fuel to generate electricity in a turbine connected to one generator and recovers waste heat to produce steam which powers another generator.

combustion turbine A rotary engine that converts the energy in a stream of liquid or gas into mechanical energy by passing the steam through a system of fixed and moving fanlike blades and causing the latter to rotate. The rotating blades are connected to a generator of electrical energy.

***Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA)** A federal law (also known as "Superfund") that provides a comprehensive framework to deal with past or abandoned hazardous materials. CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment that could endanger public health, welfare, or the environment, as well as the cleanup of inactive hazardous waste disposal sites. CERCLA has jurisdiction over any release or threatened release of any "hazardous substance" to the environment. Under CERCLA, the definition of "hazardous" is much broader than under the *Resource Conservation and Recovery Act*, and the hazardous substance need not be a waste. If a site meets the CERCLA requirements for designation, it is ranked along with other "Superfund" sites and listed on the National Priorities List. This ranking and listing is the Environmental Protection Agency's (EPA) way of determining which sites have the highest priority for cleanup.

criteria pollutants Pollutants for which national primary or national primary and secondary ambient air quality standards have been defined under Section 109 of the *Clean Air Act* to protect human health and welfare.

diffusion The process by which a pollutant plume is diluted by turbulent eddies.

discharge Under principles of hydrogeology, the amount of water passing through (or leaving) a given cross-sectional area in a given period of time. Under the *Clean Water Act*, discharge of a pollutant includes any addition of any pollutant or combination of pollutants to waters of the United States from any source point. This definition includes additions of pollutants into waters of the United States from surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately-owned treatment works.

dispersion In air pollution, the process of transport and diffusion of airborne contaminants in the atmosphere.

DOE Orders Requirements internal to the U.S. Department of Energy (DOE) that establish DOE policy and procedures, including those for compliance with applicable laws.

emission (air) Any controlled or uncontrolled release or discharge into the outdoor atmosphere of any air pollutants or combination thereof. Emission also includes any release or discharge of any air pollutant from a stack, vent, or other means into the outdoor atmosphere that originates from an emission unit.

endangered species Animals, birds, fish, plants, or other living organisms threatened with extinction by manmade changes in their environment. Requirements for declaring a species endangered are contained in the *Endangered Species Act*.

endothermic A chemistry term meaning characterized by or formed with the absorption of heat.

Environmental Information Volume (EIV) A collection of data provided by the Industrial Partner prior to preparation of an Environmental Impact Statement (EIS).

exothermic A chemistry term meaning characterized by or formed with the release of heat.

fault A surface or zone of rock fractures along which there has been displacement.

feed hopper Equipment that provides continuous feed of coal and limestone to a gasifier through a coal feeder.

floodplains Highwater channels of rivers, streams, and lakes that may be covered with water on a seasonal or episodic basis.

fugitive dust Dust that is stirred up and released into the atmosphere whether during construction activities or ongoing facility operations. Fugitive emissions composed of particulate matter.

fugitive emissions Material such as coal dust that escapes from conveyors and handling equipment.

gasifier The vessel in which coal is processed into gas.

gasification The process of converting a liquid or a solid (e.g., coal) to a gas.

geology The scientific study of the origin, history, structure, and processes of the earth.

groundwater Generally, all water contained in the ground. Water held below the water table available to freely enter wells.

hazardous air pollutant Any air pollutant subject to a standard promulgated under 42 USC Section 7412 or other requirements established under 42 USC Section 7412 of the *Clean Air Act*, including 42 USC Section 7412(g), (j), and (r) of the *Clean Air Act*.

hazardous chemical A term defined under the *Occupational Safety and Health Act* and the *Emergency Planning and Community Right to Know Act* as any chemical that is a physical hazard or a health hazard.

hazardous material A substance or material, including a hazardous substance, which has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

hazardous substance Any substance that when released to the environment in an uncontrolled or unpermitted fashion becomes subject to the reporting and possible response provisions of the *Clean Water Act* and CERCLA.

hydrocarbons One of a very large group of chemical compounds composed only of carbon and hydrogen; the largest source is from petroleum crude oil.

Inhalable particulate matter (PM_{10}) suspended aerosols and solid particles with an aerodynamic equivalent diameter that is generally less than 50 microns. The "10" in PM_{10} is not a size limit; it is the size range collected with 50 percent efficiency by certified PM_{10} samplers. PM_{10} samplers have size-dependent collection efficiencies, collecting more than 50 percent of the ambient particles having aerodynamic equivalent diameters of less than 10

microns, and collecting less than 50 percent of the ambient particles having aerodynamic equivalent diameters larger than 10 microns.

integrated gasification combined cycle A generating plant employing both coal gasification and combined-cycle power generation.

isotherm A line representing all points of equal temperature.

kilovolt (kV) A measure of electrical potential difference equal to 1,000 volts.

kilowatt (kW) A measure of electrical power equal to 1,000 watts.

kilowatt-hour (kWh) A common unit of electric energy consumption. Power (measured in kilowatts) multiplied by the time of operation (measured in hours) equals kilowatt-hours.

megawatt (MW) A measure of electrical power equal to one million watts.

megawatt-hour (Mwh) A measure of electrical energy equal to one megawatt of power supplied from an electric circuit for one hour.

mitigation Those actions that avoid, minimize, rectify, reduce or eliminate, or compensate for the impact.

National Ambient Air Quality Standards (NAAQS) Air quality concentration standards established by EPA, under the *Clean Air Act*, to protect public health and welfare.

***National Environmental Policy Act* of 1969 (NEPA)** A law that requires federal agencies to include in their decisionmaking processes appropriate and careful consideration of all potential environmental effects of proposed actions, analyses of their alternatives, and measures to avoid or minimize adverse effects of a proposed action that have the potential for significantly affecting the environment. These analyses are presented in either an environmental assessment or in an EIS.

nitrogen oxides (NO_x) A product of combustion of fossil fuels whose production increases with the temperature of the process. Under certain conditions, emissions of nitrogen oxides contribute to the formation of acid rain, particulate matter, and photochemical smog.

nonattainment areas Under the *Clean Air Act*, areas of the United States designated by EPA in which violation of one or more air quality standards for criteria pollutants is occurring.

particulates Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog found in air contaminants.

peak The greatest amount of demand occurring during a specified period of time.

peaking Generating units that operate only during system peaks or during emergencies, usually less than 20 percent of the hours in a year.

Prevention of Significant Deterioration (PSD) An EPA program in which state and/or federal permits are required that restrict emissions to BACT limits for new and modified sources in areas where air quality is in compliance with National Ambient Air Quality Standards.

prime farmland Land having the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural corps with minimum inputs of fuel, fertilizer, pesticides, and labor, without intolerable soil erosions.

Reactive Organic Compounds Organic compounds that are undergoing chemical reactions in the presence of sunlight and nitrogen oxides, resulting in the formation of ozone, particulate matter, and other components of photochemical smog.

seismicity The phenomenon of earth movements; seismic activity. Seismicity is related to the location, size, and rate of occurrence of earthquakes.

stoichiometric A chemistry term meaning relating to a branch of chemistry called stoichiometry. Stoichiometry is a branch of chemistry that deals with the application of the laws of definite proportions and of the conservation of mass and energy to chemical activity. A stoichiometric reaction is one in which the proportions of the reactants are held at certain levels, and the temperature and pressure is regulated to achieve a desired result.

sulfur dioxide (SO_2) Compound composed of sulfur and oxygen produced by the burning of sulfur and its compounds in coal, oil, and gas. It is harmful to the health of man, plants, and animals, and may cause damage to materials.

surface water All waters naturally open to the atmosphere including rivers, lakes, reservoirs, streams, impoundments, seas, estuaries.

topography The physical features of a surface area including relative elevations, and the position of natural and man-made features.

tuyeres A nozzle through which an air blast is delivered to a forge or furnace. The tuyeres in the gasifier unit are the injection points for oxygen gas, steam, and the tar and oil condensate streams.

Vitrified frit (or vitreous frit) a glassy, silica-like matrix produced in the water quench portion of the gasification process. All metals contained in the fuel feeds would be retained within the matrix of the frit upon exiting the gasifier. The frit could potentially be marketed for use in areas such as in construction as road agregate.

watershed The surface drainage area and subsurface soils and geologic formations that drain to a particular body of water.

watt (W) A basic unit of electric power. One watt is equal to 0.00134 horsepower or 0.73756 foot-pounds per second (the energy necessary to move one pound the distance of 0.73756 feet in one second).

wetland An area that is regularly saturated by surface or groundwater and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions.

9. INDEX

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11. DISTRIBUTION LIST

The U.S. Department of Energy (DOE) will provide copies of the *Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project Environmental Impact Statement* to federal, state, and local elected government officials and agencies, other organizations, and individuals listed below. Copies will be provided to other interested parties upon request.

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Kentucky Environmental Quality Commission
Kentucky River Authority
Lexington Public Library
The Nature Conservancy
Sierra Club
Sierra Club Kentucky
Trapp Elementary School

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Alex Barber	Natural Resources and Environmental Protection Cabinet
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