FUTUREGEN PROJECT
FINAL
ENVIRONMENTAL IMPACT STATEMENT

DOE/EIS-0394

Summary

NOVEMBER 2007

U.S. Department of Energy
National Energy Technology Laboratory

COVER SHEET

Responsible Agency: U.S. Department of Energy

Title: Final Environmental Impact Statement for FutureGen Project (DOE/EIS-0394)

Location: Mattoon, Illinois; Tuscola, Illinois; Jewett, Texas; and Odessa, Texas

Contact:

For further information about this Environmental Impact Statement, contact:

Mark McKoy, Document Manager
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
(304) 285-4426 or fax (304) 285-4403

For general information on the U.S. Department of Energy's process for implementing the National Environmental Policy Act, contact:

Carol Borgstrom, Director
Office of NEPA Policy and Compliance (GC-20)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0103
(202) 586-4600 or leave message at (800) 472-2756

Abstract:

The Final Environmental Impact Statement (EIS) for the FutureGen Project provides information about the potential environmental impacts of the U.S. Department of Energy's (DOE's) proposal to provide federal funding to the FutureGen Alliance, Inc. (Alliance) for the FutureGen Project. In a March 2004 Report to Congress, DOE estimated the cost of the project at $950 million in constant 2004 dollars shared at a 74/26 ratio by DOE and the Alliance. Accounting for escalation, based on representative industry indices, the project is currently estimated to cost $***1.757 billion*** in as-spent dollars. The cost estimate will be updated as work progresses.

The Alliance is a non-profit industrial consortium led by the coal-fueled electric power industry and the coal production industry. The FutureGen Project would include the planning, design, construction, and operation by the Alliance of a coal-fueled electric power and hydrogen gas production plant integrated with carbon dioxide (CO_2) capture and geologic sequestration of the captured gas. The FutureGen Project would employ integrated gasification combined cycle power plant technology that for the first time would be integrated with CO_2 capture and geologic sequestration. Four sites have been identified as reasonable alternatives and are considered in this EIS: (1) Mattoon, Illinois; (2) Tuscola, Illinois; (3) Jewett, Texas; and (4) Odessa, Texas.

DOE determined that the proposed FutureGen Project constitutes a major federal action within the meaning of the National Environmental Policy Act. The *Federal Register* "Notice of Intent to Prepare an Environmental Impact Statement for FutureGen Project" was published on July 28, 2006 (71 FR 42840). DOE held public scoping meetings at Mattoon, Illinois, on August 31, 2006; Tuscola, Illinois, on August 29, 2006; Fairfield, Texas (near Jewett), on August 22, 2006; and Midland, Texas (near Odessa), on August 24, 2006.

The Final EIS provides an evaluation of the environmental consequences that may result from the Proposed Action at each of the four candidate sites, including potential impacts on air quality; climate and meteorology; geology; physiography and soils; groundwater; surface water; wetlands and floodplains; biological resources; cultural resources; land use; aesthetics; transportation and traffic; noise and vibration; utility systems; materials and waste management; human health, safety, and accidents; community services; socioeconomics; and environmental justice. The Final EIS also provides an analysis of the No-Action Alternative, under which DOE would not provide financial assistance to the FutureGen

Project. ***The preferred alternative, to provide financial assistance to the FutureGen Project, is identified in the Final EIS.***

Public Participation:

DOE encourages public participation in the NEPA process. Comments were invited on the Draft EIS for a period of 45 days after publication of the Notice of Availability in the Federal Register on June 1, 2007. DOE considered all comments to the extent practicable. DOE conducted four public hearings to receive comments on the Draft EIS in June 2007 in Midland (Odessa), Texas; Buffalo (Jewett), Texas; Mattoon, Illinois; and Tuscola, Illinois. The public was encouraged to provide oral comments at the hearings and to submit written comments to DOE by the close of the comment period on July 16, 2007.

Changes from the Draft EIS:

Vertical lines in the left margin of a page indicate where text in the Draft EIS has been deleted, revised, or supplemented for this Final EIS, except for Volume III, which contains the public comments on the Draft EIS and DOE's responses. Additionally, revised and supplemental text in the Summary and Volumes I and II are shown in boldface italics font (as in this paragraph). Sections that include revisions are also identified in the Table of Contents.

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SUMMARY

S.1 OVERVIEW

This Environmental Impact Statement (EIS) provides an analysis of the potential environmental impacts of the proposed FutureGen Project. The project would include the planning, design, construction, and operation of the proposed FutureGen facility, a prototype electric power and hydrogen (H_2) generating plant that would employ coal gasification technology integrated with combined-cycle electricity generation and sequester carbon dioxide (CO_2) emissions. The project would also include an ongoing research program, which would be the principal feature of the prototype plant.

S.1.1 BASIS FOR U.S. DEPARTMENT OF ENERGY ACTION

The FutureGen Initiative, announced by President George W. Bush on February 27, 2003, is based on recommendations in the *National Energy Policy* (NEP), issued in May 2001 (NEP, 2001). The NEP cites, in broad terms, the need to promote diverse and secure sources of energy and the expected need for coal to play a significant role in providing that energy. The NEP specifically states, "In the long term, the goal of the [clean coal technology] program is to develop low cost, zero-emission power plants with efficiencies close to double that of today's fleet." Action is needed to support the President's announcement emphasizing the need for the FutureGen Initiative and to support other federal initiatives including the National Climate Change Technology Initiative (June 11, 2001) and the Hydrogen Fuel Initiative (January 28, 2003). These initiatives aim to reduce the Nation's output of greenhouse gas (GHG) emissions from coal-fueled energy production, to improve the global environment, and to provide advanced technologies to meet the world's energy needs.

FutureGen Initiative: *"Today I am pleased to announce that the United States will sponsor a $1 billion, 10-year demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power plant. This project will be undertaken with international partners and power and advanced technology providers to dramatically reduce air pollution and capture and store emissions of greenhouse gases. We will work together on this important effort to meet the world's growing energy needs, while protecting the health of our people and our environment."*

President George W. Bush
February 27, 2003

S.1.2 RELATIONSHIP BETWEEN THE U.S. DEPARTMENT OF ENERGY AND THE FUTUREGEN ALLIANCE

The FutureGen Project was conceived to support the initiatives and recommendations of the NEP, to foster technology for future low carbon emission power plants over the next decade, and to provide breakthroughs that would greatly reduce GHG emissions over the longer term. The lead organization for the proposed federal action is the National Energy Technology Laboratory (NETL), a multi-purpose laboratory operated by the U.S. Department of Energy's (DOE's) Office of Fossil Energy. NETL has a mission to solve the environmental, supply, and reliability constraints of producing and using fossil energy resources to promote a stronger economy and a more secure future for America. The DOE goal for this project is to prove the technical feasibility and potential economic viability of co-production of electricity and H_2 fuel from coal while capturing and sequestering CO_2 and greatly reducing other air emissions.

The FutureGen Alliance, Inc. (the Alliance), formed to partner with DOE on the FutureGen Project, is a non-profit consortium of some of the largest coal producers and electricity generators in the world. Member companies include American Electric Power, Anglo American Services Limited, BHP Billiton Energy Coal Inc., China Huaneng Group, CONSOL Energy, E.ON U.S. LLC, Foundation Coal Corporation, Peabody Energy Corporation, PPL Energy Services Group LLC, Rio Tinto Energy America Services, Southern Company Services, and Xstrata Coal. Collectively, these member companies have global operations serving customers across six continents (FG Alliance, 2006a).

On March 23, 2007, DOE and the Alliance signed a Full Scope Cooperative Agreement (the Agreement) to undertake the FutureGen Project. The Agreement defines the terms and conditions for financial assistance, including DOE's oversight role. Under the Agreement, the Alliance would be primarily responsible for implementing the FutureGen Project. DOE would guide the Alliance at a programmatic level to ensure that the FutureGen Project meets DOE's objectives. In addition to programmatic-level guidance, DOE retains certain review and approval rights for major project decisions and oversees the Alliance's compliance with the terms of the Agreement. The FutureGen Project is comprised of six budget periods with continuation into each subsequent budget period contingent upon the approval of a continuation application. The first budget period (Budget Period 0) was completed under a Limited Scope Cooperative Agreement that provided an opportunity to examine the feasibility of the project. The current Budget Period 1 of the Full Scope Cooperative Agreement will cover the remainder of the National Environmental Policy Act (NEPA) process, site selection, detailed characterization of the selected site, and preliminary design work.

S.1.3 THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

This EIS has been prepared by DOE, in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] 4321 et seq.), regulations for implementing NEPA as established by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and DOE NEPA procedures (10 CFR Part 1021). DOE will use this EIS to decide whether to provide financial assistance for the project and to determine which, if any, of the alternative sites are acceptable to DOE for hosting the FutureGen Project.

NEPA requires all federal agencies to include, in every recommendation or report on proposals for major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on (1) the environmental impact of the Proposed Action; (2) any adverse environmental effects that cannot be avoided should the proposal be implemented; (3) alternatives to the Proposed Action; (4) the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitments of resources that would be involved in the Proposed Action should it be implemented. NEPA also requires consultations with federal agencies that have jurisdiction or special expertise with respect to any environmental impact involved. The detailed statement, along with the comments and views of consulted governmental agencies, must be made available to the public.

DOE determined that providing financial assistance for the construction and operation of the FutureGen Project would constitute a major federal action that could significantly affect the quality of the natural and human environment. Therefore, DOE published an Advance Notice of Intent to prepare an EIS in the *Federal Register* on February 16, 2006 (71 FR 8283). Later, DOE published a Notice of Intent (NOI) in the *Federal Register* on July 28, 2006, to identify the reasonable site alternatives and begin the public scoping process (71 FR 42840).

Following publication in the *Federal Register* of a Notice of Availability (NOA) of the Draft EIS by the U.S. Environmental Protection Agency (EPA), there ***was*** a 45-day public review and comment period. During this period, public hearings ***were*** held at locations near each of the alternative sites. DOE ***has*** consider***ed*** and respond***ed*** to comments received on the Draft EIS both individually and collectively and **in this** Final EIS. Not less than 30 days after EPA publishes an NOA of the Final EIS, DOE will ***issue*** a Record of Decision (ROD) in the *Federal Register* that explains the agency's decision on whether to fund the FutureGen Project and, if so, which of the alternative sites would be acceptable to host the FutureGen Project.

The Alliance would then select a site from those (if any) identified as acceptable in the ROD. After selection of the host site by the Alliance, the Alliance would conduct additional site characterization work on the chosen site. This information would support site-specific design work for the FutureGen Project. Both the additional site information and the site-specific design work would be reviewed by DOE and would support the completion of a Supplement Analysis (see 10 CFR 1021.314) by DOE to determine if there are substantial changes in the Proposed Action or significant new circumstances or information relevant to environmental concerns, as discussed in 40 CFR 1502.9(c). Based on the Supplement Analysis, DOE will determine whether a Supplemental EIS should be prepared.

S.1.4 POTENTIAL DECISIONS

This EIS identifies and provides an analysis of the potential environmental impacts of constructing and operating proposed facilities for the FutureGen Project at four alternative host site locations. The EIS also analyzes a No-Action Alternative. If more than one site is approved by DOE in the ROD, the host site would be selected by the Alliance. After the host site is selected, the Alliance would conduct additional site characterization studies, prepare a site-specific design, and obtain relevant environmental, utility, and operational permits for the project.

Decisions on the incorporation of specific technologies would be made by the Alliance consistent with the overall project concept and goal. When identifying technology alternatives, the Alliance started with a list of major components and subsystems of the power plant facility and then created a matrix of potential configurations of equipment. The matrix of potential configurations has been gradually reduced to a general configuration and a list of conservative operating parameters (e.g., an upper bound for possible air emissions of various pollutants, other waste streams, and land impacts) that serve as the basis for the analyses in this EIS.

Descriptions of the alternatives and evaluations of potential impacts included in this EIS are intended to assist the federal decision-makers in choosing whether to fund the project and to determine which sites, if any, are acceptable for hosting the FutureGen Project. If DOE elects to provide further financial assistance for the FutureGen Project, the agency may also specify measures to mitigate potential impacts as identified in the NEPA process. In the absence of DOE funding (the No-Action Alternative), the Alliance may still elect to construct and operate the proposed power plant if it can obtain the additional funding and required permits. However, in the absence of DOE participation, it is unlikely the FutureGen Project would be implemented.

S.2 PURPOSE AND NEED FOR AGENCY ACTION

The purpose for agency action is to support the President's FutureGen Initiative, the National Climate Change Technology Initiative, and the Hydrogen Fuel Initiative by funding the construction and operation of a research platform and power plant facility that would be the cleanest coal-fueled power system in the world for co-producing electricity and H_2.

As the Nation's most abundant fossil fuel resource, coal must play an important role in the Nation's efforts to increase its energy independence. However, there is a need to address the associated environmental and climate change challenges related to the continued use of coal. The Intergovernmental Panel on Climate Change (IPCC) has concluded that global atmospheric concentrations of CO_2 have increased markedly since the pre-industrial period, and that the primary source of the increase results from fossil fuel use (IPCC, 2007). The IPCC was established by the United Nations Environmental Programme and the World Meteorological Organization to assess the scientific, technical, and socioeconomic information relevant for the understanding of human induced climate change.

CO_2 accounts for 83 percent of the total U.S. GHG emissions. The CO_2 emissions from the U.S. electric power sector have grown 32 percent since 1990 (compared to 2005), while in comparison, total CO_2 emissions from all energy-related sources have grown by 19 percent and total CO_2 emissions (from all reported sources) have grown by 16.9 percent. Electric power generation contributes 40 percent of all CO_2 emissions in the U.S. In 2005, 82 percent of all electricity production CO_2 emissions resulted from the burning of coal (EIA, 2006).

Fuels used in transportation account for one-third of the Nation's GHG emissions, and an alternative source of transportation fuel, such as coal-derived H_2 fuel, could help reduce GHG emissions. Therefore, methods are needed to more economically and efficiently produce H_2 fuel (e.g., through coal gasification) and to use H_2 fuel for power generation (e.g., through advanced fuel cells).

S.3 PROPOSED ACTION

DOE proposes to provide financial assistance to the Alliance to plan, design, construct, and operate the FutureGen Project. DOE has identified four reasonable alternative sites and will determine which sites, if any, are acceptable to DOE to host the FutureGen Project. The four sites currently being considered as reasonable site alternatives for the FutureGen Project are:

- Mattoon, Illinois;
- Tuscola, Illinois;
- Jewett, Texas; and
- Odessa, Texas.

In a March 2004 Report to Congress, DOE estimated the cost of the project at $950 million in constant 2004 dollars shared at a 74/26 ratio by DOE and the Alliance. Accounting for escalation, based on representative industry indices, the project is currently estimated to cost $1,757,232,310 in as-spent dollars. Including $300,800,000 in expected revenues from the sale of electricity, which would be used to offset operational costs and research and development expenses, the total net project cost is estimated to be $1,456,432,310 in as-spent dollars. DOE will share approximately 74 percent of the net cost (estimated at $1,077,760,230), which includes at least $80 million in projected contributions from foreign governments. The Alliance will share approximately 26 percent of the net cost (estimated at $378,672,080). The cost estimate will be updated as work progresses.

The FutureGen Project would be a research facility as well as the cleanest coal-fueled power system in the world. The facility would incorporate cutting-edge research as well as the development of promising new energy-related technologies at a commercial scale. Low carbon emissions would be achieved by integrating CO_2 capture and sequestration operations with the power plant (see Figure S-1). Performance and economic test results from the FutureGen Project would be shared among participants, industry, the environmental community, and the public.

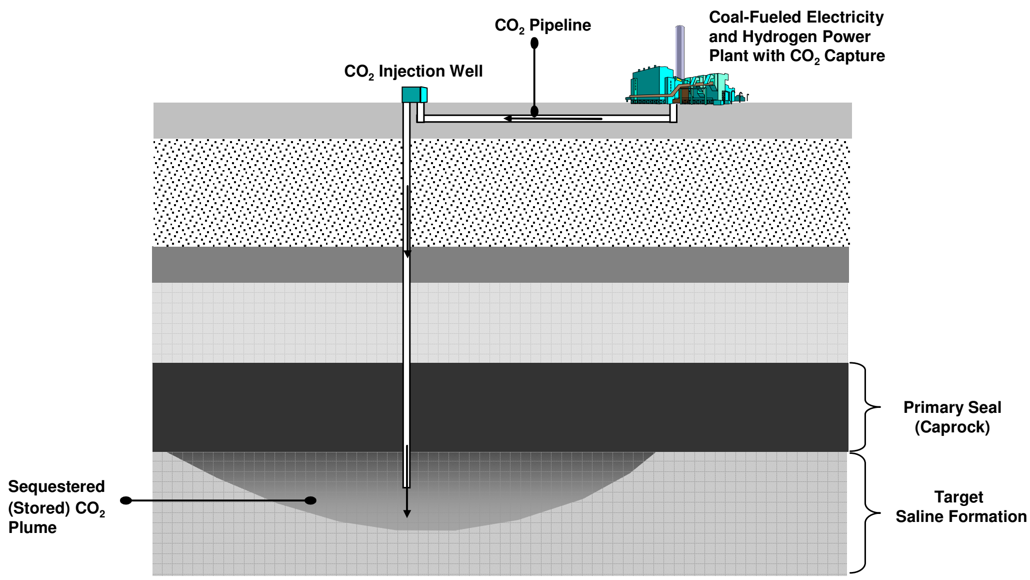


Figure S-1. FutureGen Project Overview

Construction would begin in 2009 with initial startup of the facility anticipated in 2012. DOE-sponsored activities would include construction and 4 years of plant operation, testing, and research (including 1 year of startup [i.e., research and development phase]) followed by 2 years of additional geologic monitoring for the sequestered CO_2 (see Figure S-2). After DOE-sponsored activities conclude, the Alliance or its successor would manage and operate the power plant. DOE expects the plant would operate for at least 20 to 30 years, and potentially up to 50 years.

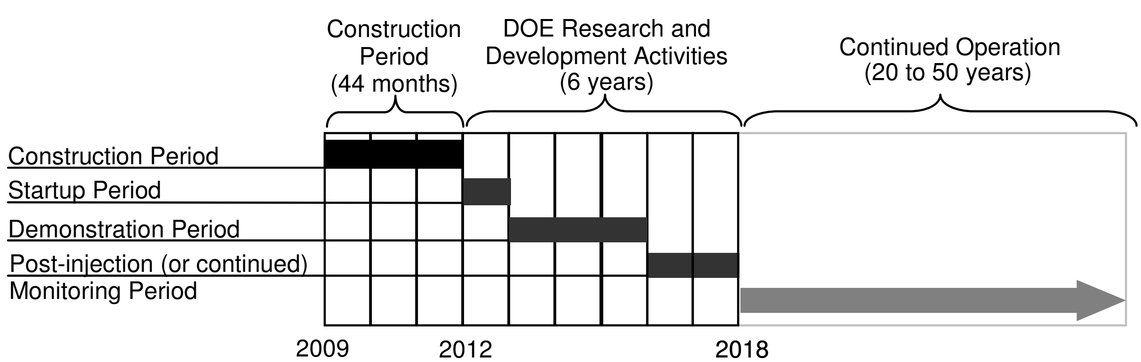


Figure S-2. Construction, Demonstration, Monitoring, and Operating Schedule

The power plant would be a 275-megawatt (MW) output Integrated Gasification Combined-Cycle (IGCC) system. CO_2 capture and geologic storage would occur at a rate of at least 1.1 million tons (1 million metric tons [MMT]) of CO_2 per year.

IGCC refers to the combination (integration) of the gasification process with a combined-cycle power plant (i.e., a plant that uses both steam turbine and combustion turbine generators).

Major components needed to support the proposed FutureGen Project include:

- A power plant site and plant infrastructure;
- A sequestration site for CO_2 injection wells and related infrastructure (surface facilities);
- A deep saline formation (i.e., the underground geologic formation where CO_2 would be stored);
- Utility connections and corridors (water supply, sanitary wastewater, electric transmission, natural gas pipelines, and CO_2 pipelines); and
- Transportation routes (rail and truck).

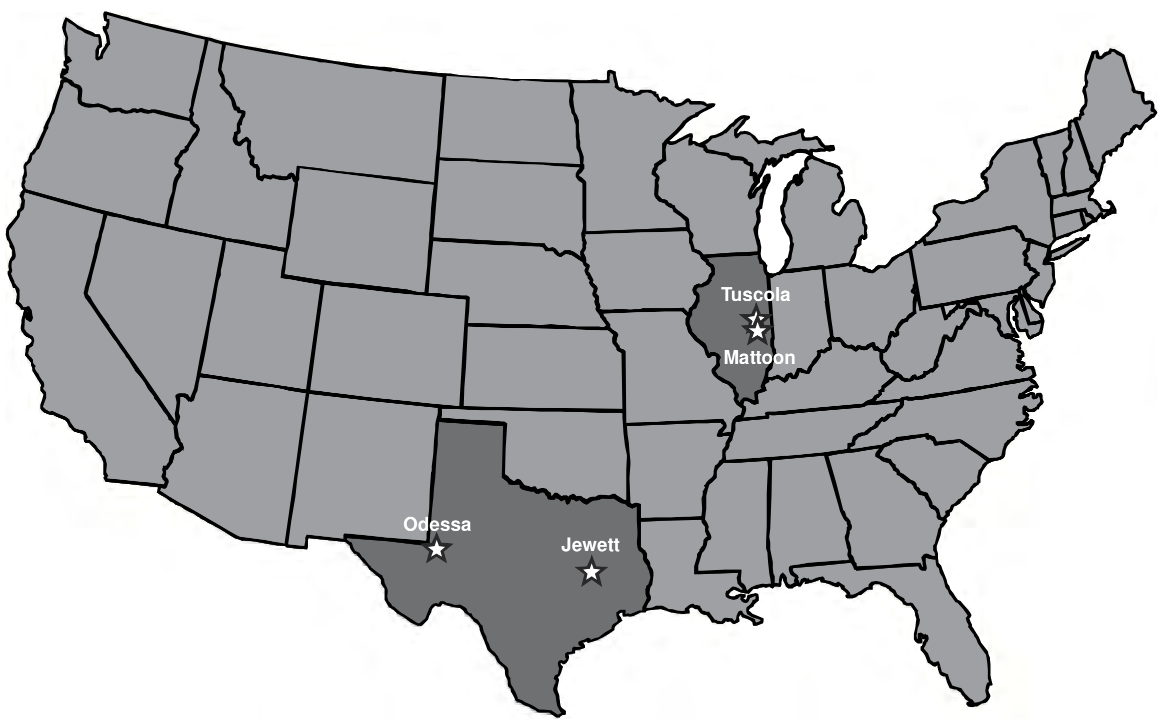
S.4 ALTERNATIVES

S.4.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would not share in the cost for constructing and operating the FutureGen Project. Without DOE funding, the Alliance would not likely undertake the commercial-scale integration of CO_2 capture and geologic sequestration with a coal-fueled power plant in a comparable timeframe. Therefore, the No-Action Alternative is considered a "No-Build" Alternative.

S.4.2 SITE ALTERNATIVES

There are four alternative site locations under consideration for the FutureGen Project (see Figure S-3). These candidate sites were identified by the Alliance through a rigorous screening and selection process. DOE reviewed the Alliance's decision-making process and findings to ensure that all reasonable alternatives were considered for analysis in this EIS. Alternatives considered but determined to be unreasonable are discussed in Section S.4.4.



Source: FG Alliance, 2006b.

Figure S-3. Alternative Site Locations

S.4.2.1 Mattoon Site

Proposed Mattoon Power Plant and Sequestration Site

The proposed Mattoon Site consists of approximately 444 acres (180 hectares) of farmland located approximately 1 mile (1.6 kilometers) northwest of the City of Mattoon, in Coles County, Illinois. Key features of the Mattoon Site are listed in Table S-1. The proposed power plant and sequestration site would be located on the same parcel of land. The proposed site is bordered to the northeast by State Route (SR) 121 and a Canadian National Railroad. Potable water would be supplied by extending existing lines from Mattoon's public water supply system. Process water would be provided from the effluent of the municipal wastewater treatment plants (WWTPs) of the cities of Mattoon and possibly Charleston, Illinois. Sanitary wastewater service would be provided through an extension of Mattoon's public wastewater system. Natural gas would be delivered through a high-pressure line that is within 0.25 mile (0.4 kilometer) of the proposed site. The proposed power plant would connect to the power grid via existing or new high voltage transmission lines. Following Table S-1, Figures S-4 and S-5 illustrate the Mattoon Site and utility corridors, respectively.

Table S-1. Mattoon Site Features

Feature	Description
Power Plant Site	The proposed Mattoon Power Plant and Sequestration Site consists of approximately 444 acres (180 hectares) located in Mattoon Township, Coles County, Illinois. The proposed site consists of 93 percent farmland and 3 percent public rights-of-way (ROWs), with the remaining percentage being rural residential development and woodlands. The Site Proponent is a group consisting of the State of Illinois (through the Illinois Department of Commerce and Economic Opportunity), the City of Mattoon, Coles County, and Coles Together (an economic development organization). The proposed site is currently privately owned, but the Site Proponent has an option to purchase the site title, which would be conveyed to the Alliance. The northeast boundary of the proposed site is adjacent to SR 121. Rail access is immediately adjacent to the northeast site boundary. The proposed power plant site is located approximately 1 mile (1.6 kilometers) northwest of Mattoon and approximately 150 miles (241.4 kilometers) south of Chicago. This Coles County site is used as farmland, is flat, and is surrounded by a rural area of low-density population.
Sequestration Site Characteristics and Predicted Plume Radius	The sequestration site is located on the same parcel of land as the power plant site. CO_2 injection would occur within the Mt. Simon saline-bearing sandstone at a depth of 1.3 to 1.6 miles (2.1 to 2.6 kilometers). The Mt. Simon formation is overlain by a thick (500- to 700-foot [152- to 213-meter]) regional seal of low permeability siltstones and shales of the Eau Claire formation and is underlain by Precambrian granitic rock. The St. Peter sandstone is proposed as an optional target reservoir. It occurs at a depth of 0.9 mile (1.4 kilometers), which is about 0.4 mile (0.6 kilometer) above the Mt. Simon formation. The St. Peter sandstone is estimated to be over 200 feet (61 meters) thick with state-wide lateral continuity. Both the Mt. Simon and St. Peter reservoirs have been successfully used for natural gas storage in other parts of Illinois.

Table S-1. Mattoon Site Features

Feature	Description
Sequestration Site Characteristics and Predicted Plume Radius (continued)	To estimate the size of the plume of injected CO_2, the Alliance used numerical modeling to predict the plume radius from the injection well. This modeling estimated that the plume radius at Mattoon could be as large as 1.2 miles (1.9 kilometers) after injecting 1.1 million tons (1 MMT) of CO_2 annually for 50 years. The dispersal and movement of the injected CO_2 would be influenced by the geologic properties of the reservoir, and it is unlikely that the plume would radiate in all directions from the injection point in the form of a perfect circle. However, for reference purposes, this modeled radius corresponds to a circular area equal to 2,789 acres (1,129 hectares). Data from a recent two-dimensional (2D) seismic line across the proposed injection site indicated that the continuity of the seismic reflectors on this seismic line suggests that there is no significant faulting cutting the plane on the seismic line within 1.5 miles (2.4 kilometers) to the west and 1.5 miles (2.4 kilometers) to the east of the Mattoon Sequestration Site (Patrick Engineering, 2006).
Utility Corridors	
Potable Water	Potable water would be supplied to the plant site from the Mattoon public potable water system. A 1-mile (1.6-kilometer) pipeline extension would be constructed within the ROW of County Road (CR) 800N from the proposed power plant site to a 10-inch (25-centimeter) potable water pipeline on 43rd Street south of SR 121.
Process Water	The proposed Mattoon Site would obtain process water from the effluent of the municipal WWTPs of Mattoon and possibly Charleston. For the Mattoon WWTP effluent, a 6.2-mile (10.0-kilometer) pipeline would be constructed, with all but 2 miles (3.2 kilometers) within an existing public ROW located within the city boundary. The Site Proponent has option contracts to buy the necessary easements for these 2 miles (3.2 kilometers) of pipeline. The possible addition of a new 8.1-mile (13.0-kilometer) pipeline from the Charleston WWTP would be within an existing ROW owned by Mattoon and Charleston. The jointly-owned ROW follows the Lincoln Prairie Grass Bike Trail, and existing 138-kilovolt (kV) overhead electric lines run the entire length. ***Additionally, after issuance of the Draft EIS, a slight modification of the 6.2-mile (10.0-kilometer) process water pipeline was submitted to the Alliance by the Site Proponent (see Sections S.4.3 and 2.4.5 and Tables S-12, 2-1, 3-3, and 4-1).*** An on-site reservoir (on the power plant property) could be constructed to store up to 25 million gallons (94.6 million liters) of process water to satisfy water requirements. A small reservoir of 7 acres (2.8 hectares) would be adequate. If a larger reservoir were constructed (approximately 40 acres [16.2 hectares] in size) with a capacity of 200 million gallons (757 million liters), the Mattoon WWTP effluent would be sufficient by itself to supply the proposed plant's process water.
Sanitary Wastewater	Sanitary wastewater service would be provided to the proposed plant site through an extension of Mattoon's existing public wastewater system. A sanitary sewer lift station would be constructed at the proposed site. A 1.25-mile (2.0-kilometer) wastewater force main would then be constructed in the ROW of SR 121 to an existing sanitary lift station at the intersection of SR 121 and 43rd Street.

Table S-1. Mattoon Site Features

Feature	Description
Electric Transmission Lines	Option 1: The proposed power plant would connect with an existing 138-kV transmission line located 0.5 mile (0.8 kilometer) from the proposed site. This line runs north-south and is owned by Ameren Corporation. A corridor easement to connect the proposed site to the existing 138-kV line has already been acquired by Mattoon. There are three scenarios to tie into this line under Option 1. Option 1a: Tie directly into the existing 138-kV line with transfer switching. Option 1b: Install a substation at the interconnection of the new easement with the existing ROW. Option 1c: Run a new transmission line south next to the existing 138-kV line and connect with the existing substation less than 2 miles (3.2 kilometers) away near Route 16. The existing substation would need to be upgraded.
Electric Transmission Lines (continued)	Option 2: Under this option, the proposed site would be connected to the nearest 345-kV line at the Neoga South Substation located 16 miles (25.7 kilometers) south of the proposed site. This option would require 16 miles (25.7 kilometers) of new line and ROW to connect the proposed plant with this substation.
Natural Gas	A natural gas mainline is located approximately 0.25 mile (0.4 kilometer) east of the proposed power plant site. This is a high-pressure line, and a new tap and delivery station would be required. The Site Proponent has obtained an option for additional land for the pipeline ROW that would give flexibility in the route to connect to this line.
CO_2 Pipeline	The CO_2 injection well for the FutureGen Project at Mattoon would be located at the proposed power plant site. Therefore, no off-site CO_2 pipeline or corridor would be necessary.
Transportation Corridors	The site is located 7 miles (11.3 kilometers) west of Interstate (I) Highway 57 (I-57), along SR 121. The Canadian National-Peoria Subdivision rail line is immediately adjacent to the northeast site boundary. The Canadian National/Illinois Central mainline connects to the Peoria Subdivision rail line approximately 3.5 miles (5.6 kilometers) from the proposed site. Illinois is located within the East North Central Demand Region for coal, which also includes Ohio, Indiana, Wisconsin, and Michigan. According to the Energy Information Administration (EIA, 2000), the East North Central Demand Region is ideally situated for access to coal, which it receives from each of the major U.S. supply regions. In 1997, the average distance that a coal shipment traveled to reach a destination in this region was about 830 miles (1,336 kilometers) (EIA, 2000). In terms of a straight-line distance, Mattoon is approximately 300 miles (483 kilometers) from the Pittsburgh Coalbed (near south-central Ohio in the northern Appalachian Basin), 900 miles (1,448 kilometers) from the Powder River Basin (PRB) (eastern Wyoming), and 50 miles (80.5 kilometers) from the nearest active coal mine within the Illinois Basin (Vermillion County, Illinois).

Source: FG Alliance, 2006c (unless otherwise noted).

S.4.2.2 Tuscola Site

Proposed Tuscola Power Plant Site

The proposed Tuscola Site consists of approximately 345 acres (140 hectares) of farmland located approximately 1.5 miles (2.4 kilometers) west of the City of Tuscola, in Douglas County, Illinois. Key features of the Tuscola Site are listed in Table S-2. Township Road (TR) 86 (750E) borders the western side of the proposed plant site and TR 47 (1050N) runs along its northern border. A CSX Railroad runs along its southern border. Potable water would be supplied through an existing water line along the southern border of the proposed site. Process water would be pumped from a water holding pond fed by the Kaskaskia River and located at the nearby Lyondell-Equistar Chemical Company. Sanitary wastewater would be treated either through a new on-site WWTP or by constructing a new sanitary force-main to the wastewater treatment system at the Lyondell-Equistar plant. The proposed power plant would connect to the power grid via existing or new high voltage transmission lines. Natural gas would be delivered through an existing line that runs through the proposed plant site. The proposed sequestration site is currently farmland situated 11 miles (17.7 kilometers) directly south of the proposed plant site. A new CO_2 pipeline would be constructed within the existing road and utility ROWs, and new ROWs running parallel to existing ROWs if required. Following Table S-2, Figures S-6, S-7, and S-8 illustrate the Tuscola Power Plant Site, utility corridors, and sequestration site, respectively.

Table S-2. Tuscola Site Features

Feature	Description
Power Plant Site	The proposed Tuscola Site consists of approximately 345 acres (140 hectares) located in east-central Illinois, 1.5 miles (2.4 kilometers) west of the City of Tuscola within Douglas County. TR 86 (750E) runs along the west border of the proposed plant site and TR 47 (1050N) runs along its northern border. The Site Proponent is a group consisting of the State of Illinois (through the Illinois Department of Commerce and Economic Opportunity), the City of Tuscola, Douglas County, and Tuscola Economic Development, Inc. The proposed site is currently privately owned, but the Site Proponent has an option to purchase the site title, which would be conveyed to the Alliance. The proposed site is located on flat farmland near an industrial complex, which is immediately west of the proposed site. The areas to the immediate north, east, and south are rural with a very low population density.
Sequestration Site Characteristics and Predicted Plume Radius	The proposed sequestration site is located in a rural area, approximately 2 miles (3.2 kilometers) south-southwest of the small town of Arcola in Douglas County in east-central Illinois. The proposed site is located 11 miles (17.7 kilometers) south of the proposed power plant site and is 3 miles (4.8 kilometers) west of I-57. The proposed sequestration site would be located on a land trust, where the trustee is the First National Bank of Arcola. The trustee has been authorized by the beneficiaries of the trust to sell the property. The proposed site is a 10-acre (4-hectare) portion of a larger parcel of 80 acres (32.4 hectares). The proposed sequestration site is located in Arcola Township, Douglas County, approximately 0.25 mile (0.4 kilometer) east of CR 750E along 000N, the Douglas-Coles County line. The site consists primarily of agricultural land with row crops.

Table S-2. Tuscola Site Features

Feature	Description
Sequestration Site Characteristics and Predicted Plume Radius (continued)	Injection would occur within the Mt. Simon saline-bearing sandstone, at a depth of between 1.3 to 1.5 miles (2.1 to 2.4 kilometers). The Mt. Simon formation is overlain by a thick (500- to 700-foot [152- to 213-meter]) regional seal of low permeability siltstones and shales of the Eau Claire Formation and is underlain by Precambrian granitic rock. The St. Peter sandstone is proposed as an optional target reservoir. It occurs at a depth of 0.9 mile (1.4 kilometers), which is about 0.4 mile (0.6 kilometer) above the Mt. Simon formation. The St. Peter reservoir is estimated to be over 100 feet (30.5 meters) thick with state-wide lateral continuity. Both the Mt. Simon and St. Peter reservoirs have been successfully used for natural gas storage in other parts of Illinois. To estimate the size of the plume of injected CO_2, the Alliance used numerical modeling to predict the plume radius from the injection well. This modeling estimated that the plume radius at the proposed Tuscola injection site could be as large as 1.1 miles (1.8 kilometers) after injecting 1.1 million tons (1 MMT) of CO_2 annually for 50 years. The dispersal and movement of the injected CO_2 would be influenced by the geologic properties of the reservoir, and it is unlikely the plume would radiate in all directions from the injection point in the form of a perfect circle. However, for reference purposes, this modeled radius corresponds to a circular area equal to 2,432 acres (984 hectares). A recent 2D seismic line across the proposed injection site indicated that the continuity of seismic reflectors on this seismic line suggest that there is no significant faulting cutting the plane of the seismic line within 1 mile (1.6 kilometers) to the west and 2.5 miles (4.0 kilometers) to the east of the Tuscola Sequestration Site (Patrick Engineering, 2006).
Utility Corridors	
Potable Water	Potable water would be supplied to the proposed power plant by tapping an existing 8-inch (20.3-centimeter) water line operated by the Illinois American Water Company. This line runs along the southern boundary of the property along the CSX Railroad. Tapping into the existing water line would require less than 1 mile (1.6 kilometers) of new construction.
Process Water	The proposed power plant would receive its process water from an existing 150 million-gallon (568 million-liter) water holding pond at the Lyondell-Equistar Chemical Company located west of the proposed site. This pond contains raw water pumped from the adjacent Kaskaskia River. A 1.5-mile (2.4-kilometer) force main would be constructed to pump water from the pond to the plant, crossing property owned by Lyondell-Equistar Chemical Company and Cabot Corporation, as well as an existing township ROW.
Sanitary Wastewater	Option 1: Under Option 1, an on-site WWTP would be constructed at the proposed plant site. The treated effluent from this facility could then be discharged into an on-site reservoir (if constructed) and then reused as process water. Option 2: Under Option 2, a 0.9-mile (1.4-kilometer) sanitary force-main would be constructed to the existing wastewater treatment system at the Lyondell-Equistar Chemical Company. Once treated, this effluent could potentially be discharged into the existing 150 million-gallon (568 million-liter) reservoir to be reused as process water for the proposed power plant. There is an abandoned 8-inch (20.3-centimeter) potable water pipeline at the property that could potentially be used as a sanitary force-main to the Lyondell-Equistar WWTP. This line would require hydraulic testing before it could be put into service.
Electric Transmission Lines	Option 1: The nearest electric transmission line to the proposed power plant site is a 138-kV line located 0.5 mile (0.8 kilometer) north of the proposed site. This line is owned and operated by Ameren Corporation. The connection to this line would require additional ROW. Under Option 1, the proposed plant would tie into this existing 138-kV line.

Table S-2. Tuscola Site Features

Feature	Description
Electric Transmission Lines (continued)	Option 2: If the interconnection of the proposed plant to the electric grid required use of a 345-kV line, a new 345-kV line that would parallel or replace the existing 138-kV line would be constructed for approximately 17 miles (27.4 kilometers) and connect to a substation where the line currently joins the 345-kV Sidney-Kansas line. Approximately 3 miles (4.8 kilometers) of new ROW would be required. An interconnection study has been requested and would dictate the ultimate line requirements.
Natural Gas	Natural gas would be delivered to the proposed plant from an existing natural gas mainline that runs through the proposed power plant site. Because the pipeline is a high-pressure line, a new tap and delivery station would be required.
CO_2 Pipeline	A new 11-mile (17.7-kilometer) pipeline would be constructed to transport CO_2 to the proposed sequestration site 10 miles (16.1 kilometers) due south of the proposed plant site. The pipeline would be constructed across existing State of Illinois, Douglas County, and Township ROWs and would occupy new ROWs where needed. The pipeline corridor would run parallel to CR 750E and 700E to the injection location.
Transportation Corridors	There are four railroads nearby: CSX Transportation borders site, Union Pacific (1.5 miles [2.4 kilometers]), Canadian National (1.5 miles [2.4 kilometers]), and Norfolk Southern (approximately 30 miles [48.3 kilometers]). The proposed site is bordered by TR 86 and TR 47. Illinois is located within the East North Central Demand Region for coal, which also includes Ohio, Indiana, Wisconsin, and Michigan. According to the Energy Information Administration (EIA, 2000), the East North Central Demand Region is ideally situated for access to coal, which it receives from each of the major U.S. supply regions. In 1997, the average distance that a coal shipment traveled to reach a destination in this region was about 830 miles (1,336 kilometers) (EIA, 2000). In terms of a straight line distance, Tuscola is approximately 300 miles (483 kilometers) from the Pittsburgh Coalbed (near south-central Ohio in the northern Appalachian Basin), 900 miles (1,448 kilometers) from the PRB (eastern Wyoming), and within 35 miles (56.3 kilometers) of the nearest active coal mines in the Illinois Basin (Vermillion County, Illinois).

Source: FG Alliance, 2006d (unless otherwise noted).

S.4.2.3 Jewett Site

Proposed Jewett Power Plant Site

(NRG Limestone Generating Station in the background)

The proposed Jewett Site is located in east-central Texas on approximately 400 acres (162 hectares) of formerly mined land northwest of the Town of Jewett. Key features of the Jewett Site are listed in Table S-3. The proposed site is located at the intersection of Leon, Limestone, and Freestone counties, and bordered by Farm-to-Market Road (FM) 39. The Burlington Northern Santa Fe Railroad runs along the northeastern border of the proposed site. Potable water and process water would be obtained by drilling new wells on site or nearby. Sanitary wastewater would be treated through a new on-site wastewater treatment system. The proposed power plant would connect to the power grid via existing high voltage transmission lines. Natural gas would be delivered through an existing gas pipeline located at the northeastern corner of the proposed plant site. The proposed sequestration injection wells would be located on both private ranchland and state-owned prison land approximately 33 miles (53.1 kilometers) northeast of the proposed power plant site. A new CO_2 pipeline would be installed largely along existing ROWs, but would require some new ROWs. Following Table S-3, Figures S-9, S-10, and S-11 illustrate the Jewett Power Plant Site, utility corridors, and sequestration site, respectively.

Table S-3. Jewett Site Features

Feature	Description
Power Plant Site	The proposed Jewett Site is located in east-central Texas on approximately 400 acres (162 hectares) of land northwest of the Town of Jewett. The proposed site is located at the intersection of Leon, Limestone, and Freestone counties on FM 39 near US 79. The area is characterized by very gently rolling reclaimed mine lands immediately adjacent to an operating lignite mine and the nominal 1800-MW NRG Limestone Generating Station (power plant). The Site Proponent is the State of Texas. The proposed power plant site is currently held by one property owner – NRG Texas.
Sequestration Site Characteristics and Predicted Plume Radius	***The proposed Jewett Sequestration Site includes three proposed injection wells located in a rural area about 33 miles (53 kilometers) northeast of the proposed power plant site. Two of the proposed injection well sites are located about 16 miles (28 kilometers) east of the Town of Fairfield in Freestone County, about 60 miles east of Waco. The third proposed injection well site is about 5 miles (8 kilometers) east on Texas Department of Criminal Justice (TDCJ) property in Anderson County about 16 miles (28 kilometers) west of the City of Palestine.*** The land use at the proposed sequestration site is primarily agricultural, with few residences located over the projected plume. Injection would occur on a private ranch (Hill Ranch) and on adjoining state property managed by the TDCJ. Two injection wells are proposed for injection into the Woodbine formation. In addition, one more injection well is proposed for injection into the deeper Travis Peak formation at a much lower injection rate than the primary Woodbine wells to take advantage of CO_2 sequestration research opportunities on low permeability reservoirs. The Travis Peak well would not be required in addition to the Woodbine injection wells to accommodate the output of the proposed power plant. One of the Woodbine injection wells and the Travis Peak well would be located on the Hill Ranch property. The other Woodbine injection well would be located on TDCJ property. Under the proposed injection plan, each of the Woodbine wells would be used to inject 45 percent of the total CO_2 output with the remaining 10 percent injected into the Travis Peak well.

Table S-3. Jewett Site Features

Feature	Description
Sequestration Site Characteristics and Predicted Plume Radius (continued)	Both the Woodbine and Travis Peak formations lie beneath a primary seal, the Eagle Ford Shale, which has a thickness of 400 feet (122 meters). The primary injection zone, the Woodbine sandstone, is directly beneath the Eagle Ford. There are also over 0.4 mile (0.6 kilometer) of low permeability carbonates and shales above the Eagle Ford that create additional protection for shallow ***underground sources of drinking water***. The injection depth within the Woodbine formation would be 1 to 1.1 miles (1.6 to 1.8 kilometers). Injection into the Travis Peak formation would occur between 1.7 to 2.1 miles (2.7 to 3.4 kilometers) below the ground surface. To estimate the size of the plume of injected CO_2, the Alliance used numerical modeling to predict the plume radius from the injection wells. This modeling estimated that the plume radius at the proposed Jewett injection site could be as large as 1.7 miles (2.7 kilometers) per Woodbine injection well, 50 years after injecting 2.8 million tons (2.5 MMT) of CO_2 annually for the first 20 years, followed by 30 years of gradual plume spreading. The dispersal and movement of the injected CO_2 would be influenced by the geologic properties of the reservoir, and it is unlikely that the plume would radiate in all directions from the injection point in the form of a perfect circle. However, for reference purposes, this modeled radius corresponds to a circular area equal to 5,484 acres (2,219 hectares). A total of 10,968 acres (4,439 hectares) is estimated for all three wells.
Utility Corridors	
Potable Water	Potable water would be supplied in the same manner as the proposed plant's process water, by installing new wells either on the property or off site. This would require 1 mile (1.6 kilometers) of new construction.
Process Water	Process water would be provided by installing wells on the proposed site or possibly off site into the Carrizo-Wilcox Aquifer. Because the wells would be located on or close to the proposed plant site, only a small length of distribution pipeline, less than 1 mile (1.6 kilometers), would be required to deliver water to the proposed plant.
Sanitary Wastewater	Sanitary wastewater would be treated and disposed of through construction and operation of an on-site sanitary WWTP. Effluent from the WWTP would be treated and disposed of in accordance with local and state regulations or recycled back into the power plant for process water.
Electric Transmission Lines	Option 1: The proposed power plant would connect to a 345-kV transmission line bordering the plant site. Option 2: The proposed power plant would connect to a 138-kV line approximately 2 miles (3.2 kilometers) from the site on a new ROW.
Natural Gas	Natural gas would be delivered through an existing natural gas pipeline located at the northwestern corner of the proposed power plant site. This pipeline is owned and operated by Energy Transfer Corporation.
CO_2 Pipeline	A new CO_2 pipeline would be required to connect the proposed power plant site to the proposed sequestration site. The pipeline would be up to 59 miles (95 kilometers) in length and the ROW would be approximately 20 to 30 feet (6.1 to 9.1 meters) wide. The proposed CO_2 pipeline has been divided into the following common segments, except for segments A-C and B-C, which are alternatives between the proposed plant site and the beginning of segment C: • Segment A-C would begin on the northeastern side of the proposed plant site and follow 2 miles (3.2 kilometers) of existing ROW owned by the Burlington Northern – Santa Fe Railroad. It would continue approximately 3 miles (4.8 kilometers) along a new ROW until it intersects a section of a natural gas pipeline ROW. The corridor would then follow this pipeline another 3 miles (4.8 kilometers) east until it joins a larger trunk of a natural gas pipeline.

Table S-3. Jewett Site Features

Feature	Description
CO_2 Pipeline (continued)	• Segment B-C would begin along the southern boundary of the proposed plant site and extend southeast approximately 2.5 miles (4.0 kilometers) along FM 39. It then would turn northeast and follow the existing ROW of a natural gas pipeline for another 4 miles (6.4 kilometers) until it joins a ROW for a larger trunk of a natural gas pipeline that extends northwest for approximately 8 miles (12.9 kilometers). • Segment C-D would follow an existing natural gas line ROW northward for approximately 15 miles (24.1 kilometers). • Segment D-E is no longer being evaluated for this project; therefore, it is not addressed in this EIS. • Segment D-F would continue northward along the existing natural gas line ROW for another 9 miles (14.5 kilometers). • Segment F-G would extend in a straight line east along a new ROW approximately 6 miles (9.7 kilometers) to the proposed sequestration wells on the Hill Ranch. • Segment F-H would continue northward along the existing natural gas line corridor for almost 2 miles (3.2 kilometers) where it would cross the Trinity River to the north side. It then would intersect another leg of a natural gas pipeline ROW and continue east for approximately 6 miles (9.7 kilometers). The line would then continue in a generally eastward direction along a county highway (CH) ROW and TDCJ land for approximately another 6 miles (9.7 kilometers) to the proposed injection well site on TDCJ land.
Transportation Corridors	The proposed Jewett Site is bordered by FM 39, which intersects US 79 and State Highway (SH) 164 within 10 miles (16.1 kilometers) of the site boundary. The Burlington Northern – Santa Fe Railroad also runs along the northeastern border of the proposed power plant site. Texas is located in the West South Central Demand Region for coal, which also includes Louisiana, Arkansas, and Oklahoma. According to the Energy Information Administration (EIA, 2000), the West South Central Demand Region receives the majority of its coal resources from the PRB and the Rockies. In 1997, the average distance that a coal shipment traveled to reach a destination in this region was about 1,300 miles (2,092 kilometers) (EIA, 2000). In terms of a straight line distance, Jewett is approximately 950 miles (1,529 kilometers) from the Pittsburgh Coalbed (south-central Ohio in the northern Appalachian Basin), 650 miles (1,046 kilometers) from the Illinois Basin coals (southern Illinois), and 1,000 miles (1,609 kilometers) from the PRB coal supplies (eastern Wyoming). In addition, Texas lignite is available from the on-site Westmoreland Coal Company mine and perhaps other regional mines.

Source: FG Alliance, 2006e (unless otherwise noted).

S.4.2.4 Odessa Site

Proposed Odessa Power Plant Site

The proposed Odessa Site is located on approximately 600 acres (243 hectares) 15 miles (24.1 kilometers) southwest of the City of Odessa in Ector County, Texas. Key features of the Odessa Site are listed in Table S-4. The proposed site is located just north of I-20 and is north of the Town of Penwell and a Union Pacific Railroad. The land has historically been used for ranching as well as oil and gas activities. Potable water and process water would be obtained by developing new well fields nearby or from several existing water well fields ranging from 24 to 54 miles (38.6 to 86.9 kilometers) from the proposed plant site ***or possibly from the Colorado River Municipal Water District (CRMWD) (see Section S.4.3 and 2.4.5)***. Sanitary wastewater would be treated through construction and operation of an on-site treatment system. The proposed power plant would connect to the power grid via existing high voltage transmission lines located approximately 1.8 miles (2.9 kilometers) from the site. Natural gas would be obtained from an existing gas pipeline that traverses the proposed plant site.

The proposed sequestration site would be located 58 miles (93.3 kilometers) south of the proposed power plant site on ***42,300*** acres (17,118 hectares) on University of Texas land. An existing CO_2 pipeline would transport the power plant's CO_2 to the sequestration site, although up to 14 miles (22.5 kilometers) of new CO_2 pipeline would be installed to connect the proposed power plant and the proposed sequestration site to the existing pipeline. ***Additionally, after issuance of the Draft EIS, two additional and reasonable CO_2 pipeline options were submitted to DOE (see Section S.4.3). Option 1 would involve the construction and operation of a new, approximately 90-mile (145-kilometer) pipeline along existing ROWs; and Option 2 which would involve the use of existing pipeline and the construction of a new, approximately 30-mile (48-kilometer) pipeline and a separate sulfur removal plant.*** Following Table S-4, Figures S-12, S-13, and S-14 illustrate the Odessa Power Plant Site, utility corridors, and sequestration site, respectively.

Table S-4. Odessa Site Features

Feature	Description
Power Plant Site	The proposed Odessa Site is located on about 600 acres (243 hectares) approximately 15 miles (24.1 kilometers) southwest of the City of Odessa in Ector County, Texas. The proposed site consists of flat land near I-20 and across the Union Pacific Railroad from the Town of Penwell. The Site Proponent is the State of Texas. Both the proposed site and surrounding land to the east, west, and north are rural areas where land use has been dominated historically by ranching and oil and gas activities (Horizon Environmental Services, 2006). Unimproved roads and structures related to oil and gas well activities are found on and around the proposed site, with most oil production activities historically occurring immediately west of the proposed site. Several pipelines also traverse the proposed site boundaries. The entire property within the proposed power plant site boundary is owned by a single owner.

Table S-4. Odessa Site Features

Feature	Description
Sequestration Site Characteristics and Predicted Plume Radius	The proposed sequestration site is located in a semi-arid, sparsely populated area adjacent to I-10 in Pecos County, Texas. The proposed site, owned by the University of Texas, is located 58 miles (93.3 kilometers) south of the proposed power plant near Odessa, Texas, and is about 60 miles (96.6 kilometers) south of the Midland-Odessa International Airport. ***The proposed injection site would be approximately 13 miles (21 kilometers) east of Fort Stockton, Texas.*** ***Proposed injection targets for this site include a lower interval (the Delaware Mountain Group sandstones) and an upper interval (the lower part of Queen formation sandstones).*** The injection target would be at a depth of between 0.4 mile to 1 mile (0.6 to 1.6 kilometers). These sandstone intervals are separated by an intermediate seal that consists primarily of non-porous and impermeable carbonates of the Goat Seep Limestone. The upper injection horizon is overlain by a 700-foot (213-meter) thick primary seal, the Queen-Seven Rivers formation.
Sequestration Site Characteristics and Predicted Plume Radius (continued)	To estimate the size of the plume of injected CO_2, the Alliance used numerical modeling to predict the plume radius from the proposed injection wells. This modeling estimated that the plume radius at the proposed Odessa injection site could be as large as 1 mile (1.6 kilometers) per well after injecting 1.1 million tons (1 MMT) of CO_2 annually for 50 years. The dispersal and movement of the injected CO_2 would be influenced by the geologic properties of the reservoir and it is unlikely the plume would radiate in all directions from the injection point in the form of a perfect circle. However, for reference purposes, this modeled radius corresponds to a circular area equal to 2,136 acres (864 hectares). A minimum of three wells would be required to support a constant 1.1 million tons (1 MMT) per year injection rate. A minimum of eight wells would be needed to support a 2.8 million tons (2.5 MMT) per year injection rate. Assuming a total of 55 million tons (50 MMT) of CO_2 is injected, the total plume area would be 6,980 acres (2,825 hectares) assuming eight wells would be required to inject 2.8 million tons (2.5 MMT) per year for the first 20 years of a 50-year time period. A slightly smaller area (6,073 acres [2,458 hectares]) would be required if only three wells were needed to inject 1.1 million tons (1 MMT) per year for each year in a 50-year time period. ***The sequestration site contains an estimated 42,300 acres (17,118 hectares) of land.***
Utility Corridors	
Potable Water	Potable water would potentially be obtained through the same sources identified for process water.

Table S-4. Odessa Site Features

Feature	Description
Process Water	Process water could be acquired by developing new well fields or from several existing well fields that draw water from the Ogallala, Pecos Valley, Edwards-Trinity Plateau, Dockum, or Capitan Reef aquifers. Six existing well fields have been identified that could deliver water to the site, ranging from 24 to 54 miles (38.6 to 86.9 kilometers) from the proposed power plant site (straight-line distance). Any of these six potential sources would require pipeline construction along new ROWs. ***Since the issuance of the Draft EIS, the Site Proponents have provided another process water option. Odessa has offered to provide raw or treated water from the City of Odessa's water treatment plant using a new, approximately 17-mile (27.4-kilometer), process water pipeline (see Figure S-A). All but 1 mile (1.6 kilometers), approximately 5,000 feet (1,524 meters), of the distance of the new process water pipeline would either use existing public road ROWs (e.g., it would be installed under ground on the north side of 42nd Street) or be within the region of influence (ROI) analyzed in the Draft EIS for the Texland Great Plains water corridor. The new, less than 1-mile (1.6-kilometer) corridor requiring new ROW would traverse rangeland similar to that described for the Texland Great Plains water corridor.*** ***The water supply would be from the City of Odessa which receives its raw water from the Colorado River Municipal Water District (CRMWD). The CRMWD is the legislatively created entity whose mission is to provide water to several communities in this region of Texas. The CRMWD currently owns and utilizes three reservoirs and four active well fields (the groundwater is typically used only during summer months to meet peak demands) (City of Odessa, 2007).***
Sanitary Wastewater	Sanitary wastewater would be treated and disposed of through construction and operation of a new on-site sanitary WWTP. Effluent from the WWTP would be treated and disposed of in accordance with local and state regulations or recycled back into the proposed power plant for use as process water.
Electric Transmission Lines	The proposed power plant would connect with one of two 138-kV transmission lines, one approximately 0.7 mile (1.1 kilometers) on new ROW and the second approximately 1.8 miles (2.9 kilometers) on existing ROW from the proposed site. In either case, the interconnection would only require the construction of a substation and a short transmission line to tie into these lines. The southern corridor would follow an existing ROW along FM 1601, which borders the proposed site, while a new ROW would be required for the northern route option.
Natural Gas	The proposed power plant would tap an existing natural gas pipeline that traverses the proposed plant site and that is owned and operated by ATMOS Energy.

Table S-4. Odessa Site Features

Feature	Description
CO_2 Pipeline	***As proposed in the Draft EIS,*** **the proposed injection wells would be located on 42,300 acres (17,118 hectares)** of University of Texas lands, 58 miles (93.3 kilometers) south of the proposed Odessa Power Plant Site. CO_2 would be transported in (and co-mingled in) an existing ***CO_2 pipeline with varying diameter just east of the plant site operated by Kinder Morgan CO_2 Company (the Central Basin CO_2 pipeline). The CO_2 would then flow into one or two pipelines owned by PetroSource Inc. (the Comanche Creek Pipeline or the Val Verde Pipeline).*** Two miles (3.2 kilometers) of new CO_2 pipeline would connect the proposed power plant site to the existing ***Central Basin pipeline****,* and approximately 7 to 14 miles (11.3 to 22.5 kilometers) of new pipeline would connect the existing ***PetroSource pipelines*** to the proposed injection site. Because multiple injection wells would be used, intra-well piping would also be installed to connect the wells to the main pipelines. ***Since issuance of the Draft EIS, Alliance and DOE investigations have revealed that it would not be feasible at this time to transport CO_2 from the proposed power plant site at Odessa to the proposed injection well site using the PetroSource Val Verde CO_2 pipeline located east of the injection site, as originally stated in the Draft EIS. Therefore, Odessa has offered two additional CO_2 pipeline options:*** • ***Option 1- Construction and operation of a new, approximately 90-mile (145-kilometer) dedicated pipeline from the FutureGen plant to the injection site along existing rights-of-way; and*** • ***Option 2 – Use of existing pipeline owned by Kinder Morgan CO_2 Company and the construction and operation of a new, approximately 30-mile (48-kilometer) dedicated pipeline (ranging from 6 to 12 inches [15.2 to 30.5 cm] in diameter) from the end of the Kinder Morgan line (near McCamey, Texas) to the injection sites. Option 2 would require additional sulfur removal either at the FutureGen plant or in a separate sulfur removal plant operated by Kinder Morgan.*** ***The original option could be used to transport CO_2 to the sequestration site only through the PetroSource Inc. Comanche Creek Pipeline (it was learned that the Val Verde Pipeline flows the wrong direction). The Comanche Creek Pipeline is a 6-inch (15.2 cm) diameter pipeline that with upgrades, could carry only enough CO_2 to reach the goal of MMT/yr, but it could not deliver the maximum amount that could be captured by FutureGen's 2.8 MMT/yr.***
Transportation Corridors	The southern border of the proposed plant site is less than 0.5 mile (0.8 kilometer) from I-20, with an improved roadway that borders the property. A Union Pacific Railroad line runs along the southern border of the site. Deliveries to or from the proposed site could be accomplished by either rail or truck. Texas is located in the West South Central Demand Region for coal, which also includes Louisiana, Arkansas, and Oklahoma. According to the Energy Information Administration (EIA, 2000), the West South Central Demand Region receives the majority of its coal resources from the PRB and the Rockies. In 1997, the average distance that a coal shipment traveled to reach a destination in this region was about 1,300 miles (2,092 kilometers) (EIA, 2000). In terms of a straight-line distance, Odessa is approximately 1,250 miles (2,012 kilometers) from the Pittsburgh Coalbed (south-central Ohio in the northern Appalachian Basin), 900 miles (1,448 kilometers) from the Illinois Basin (southern Illinois), and 800 miles (1,287 kilometers) from the PRB (eastern Wyoming). While no sources of coal are available near the proposed plant site, Texas does have several coal mines in the eastern and southern portions of the state. The closest operating Texas coal mine is the Eagle Pass Mine, approximately 250 miles (402 kilometers) to the southwest of Odessa.

Source: FG Alliance, 2006f (unless otherwise noted).

S.4.3 NEW OPTIONS FROM SITE PROPONENTS' BEST AND FINAL OFFERS

To complete the site proposal process, the Alliance offered an opportunity for the Site Proponents to submit Best and Final Offers (BAFOs) on their proposals. Pursuant to directions from the Alliance, the four candidate Site Proponents submitted BAFOs to the Alliance on August 1, 2007.

The Mattoon and Odessa Site Proponents provided additional water and CO_2 pipeline options for the Alliance to consider in its final siting decision. Neither the Tuscola nor Jewett Site Proponents put forward additional options for consideration that might have potential environmental impacts. Other information provided by the Site Proponents in their BAFO submissions relates solely to potential business arrangements between the Alliance and the Site Proponents.

The new Mattoon and Odessa options were not described in the Draft EIS. Nevertheless, as variations of the alternatives, DOE is considering their potential environmental consequences in this section of the EIS. The following additional options are considered reasonable for purposes of NEPA analysis.

S.4.3.1 Mattoon Process Water Pipeline

After issuance of the Draft EIS, a slight modification of the 6.2-mile (10.0-kilometer) process water pipeline was submitted to the Alliance by the Site Proponent (see Table S-1). As described in the Draft EIS, a 6.2-mile (10.0-kilometer) process water pipeline would be constructed, with all but 1 mile (1.6 kilometers) within an existing public ROW located within the city boundary. The new 1-mile (1.6-kilometer) corridor requiring new ROW would be constructed along the south side of a road. To avoid a potential land use conflict, however, Mattoon has obtained an easement for one parcel of land along the north side of the road, such that the process water pipeline would cross underneath the road at that property line and continue along the north side of the road for approximately 0.5 mile (0.8 kilometer), crossing back underneath the road to continue along the south side of the road as originally proposed. This slight modification of the process water pipeline alignment would have the same types and magnitudes of impacts as those described in this EIS.

S.4.3.2 Odessa Process Water Pipeline

Odessa has offered to provide raw or treated water from the City of Odessa's water treatment plant using a new, approximately 17-mile (27.4-kilometer), process water pipeline (see Figures S-A and 2-A). All but 1 mile (1.6 kilometers), approximately 5,000 feet (1,524 meters), of the distance of the new process water pipeline would either use existing public road ROWs (e.g., it would be installed under ground on the north side of 42nd Street) or be within the ROI analyzed in the Draft EIS for the Texland Great Plains water corridor. The new, less than 1-mile (1.6-kilometer) corridor requiring new ROW would traverse rangeland similar to that described for the Texland Great Plains water corridor.

The water supply would be from the City of Odessa which receives its raw water from the Colorado River Municipal Water District (CRMWD). The CRMWD is the legislatively created entity whose mission is to provide water to several communities in this region of Texas. The CRMWD currently owns and utilizes three reservoirs and four active well fields (the groundwater is typically used only during summer months to meet peak demands) (City of Odessa, 2007).

The CRMWD has sufficient excess supply to meet the FutureGen Project water demand. The CRMWD acquires surface water from three primary sources. The largest is the O.H. Ivie Reservoir in Concho County. Water from the O.H. Ivie Reservoir is delivered to the City of Odessa water treatment plant through a 60-inch (1.52-meter) diameter, approximately 157-mile (253-kilometer) pipeline (CRMWD, 2007). However, water from J.B. Thomas and E.V. Spence reservoirs can also be furnished to the City of Odessa water treatment plant.

The firm yield (maximum yield that can be delivered by the O.H. Ivie Reservoir even through a severe drought) is approximately 95,000 acre-feet per year (equivalent to 85 million gallons per day [MGD] or 320 million liters per day [MLD]). Major long-term contract users of this source include the City of Abilene, City of Midland, and City of San Angelo, whose combined contract amount is 45,000 acre-feet per year (equivalent to 40.1 MGD or 152 MLD) (TWDB, 2001a), which is less than half of the firm yield of the reservoir. The combined permitted diversion from the E.V. Spence and J.B. Thomas reservoirs is 3,000 acre-feet per year (equivalent to 2.7 MGD or 10 MLD) (TWDB, 2001b).

Groundwater is used in conjunction with CRMWD's surface reservoirs to meet customer demands during periods of low flow in surface waters. The CRMWD obtains groundwater from four active well fields: Ward County, Odessa, Snyder, and Martin. The largest well field is the Ward County field located near Monahans, about 25 miles (40 kilometers) west of the Odessa Site. This well field produces water from the Pecos aquifer, and consists of approximately 37 wells. Information on groundwater availability of the Pecos aquifer within Ector, Winkler, and Ward counties is provided in Section 7.6. This well field has a peak capacity of about 28 MGD (106 MLD). About 24 MGD (91 MLD) of this water can be delivered to the City of Odessa water treatment plant (CRMWD, 2007). The remaining three well fields are typically used as back-up or standby supplies.

The City of Odessa's water treatment plant has a peak capacity of approximately 50 MGD (189 MLD) for surface water and 20 MGD (76 MLD) for groundwater (City of Odessa, 2007). The City's peak daily demand is approximately 36.5 MGD (135 MLD). FutureGen would require 4.3 MGD (16.2 MLD), so that even during peak water demand, the City's water treatment plant would have adequate water and treatment capacity to supply water to the FutureGen Project (see Tables S-A and 2-A).

Table S-A. City of Odessa Water Supply and Treatment Capacity

Water Supply – O.H. Ivie Reservoir	*40.1 MGD (152 MLD)*
Water Supply – E.V. Spence and J.B. Thomas reservoirs	*2.7 MGD (10.2 MLD)*
Groundwater Supply – Ward County	*24.0 MGD (91 MLD)*
Total Available Water Supply	*0 MGD (253 MLD)*
Treatment Capacity	*70.0 MGD (265 MLD)*
Peak Daily Demand	*36.5 MGD (135 MLD)*
FutureGen Demand	*4.3 MGD (16.2 MLD)*
Peak Daily Demand with FutureGen	*40.8 MGD (154 MLD)*

Source: City of Odessa, 2007.

The original proposal and Section S.4.2.4, Table S-12, Sections S.10.3.3, 2.4.4, and 2.4.5, Table 3-3, and Chapter 7, stated that process water would be acquired by developing new well fields or from several existing well fields that draw water from different groundwater aquifers; up to 54 miles (86.9 kilometers) of new pipeline ROW would be required. The option to obtain process water from the City

of Odessa would require a shorter pipeline (of which about 60 percent would use existing ROW) and thus would likely have fewer impacts than the longer pipeline options that were described in the proposal (see Tables S-12 and 3-3). The new pipeline option would cross similar terrain as the pipeline options analyzed in the EIS for Odessa; therefore, impacts would be similar.

S.4.3.3 Odessa CO_2 Pipeline Options

The original proposal (and EIS sections identified in Sections S.4.2.4, 2.4.4 and 2.4.5, and Chapter 7) stated that CO_2 would be transported (and co-mingled) in existing Kinder Morgan and PetroSource CO_2 pipelines leading to the injection site, with an approximately 2-mile (3.2-kilometer) CO_2 pipeline spur from the FutureGen plant to the existing Kinder Morgan CO_2 pipeline and 7- to 14-mile (11.3- to 22.5-kilometer) spurs from the existing PetroSource CO_2 pipelines to the injection well sites.

Odessa also offered two additional CO_2 pipeline options (see Figures S-B, 2-B, S-C, 2-C):

- ***Option 1 – Construction and operation of a new, approximately 90-mile (145-kilometer) dedicated pipeline from the FutureGen plant to the sequestration site along existing ROWs (Figures S-B and 2-B); and,***
- ***Option 2 – Use of the existing pipeline owned by Kinder Morgan CO_2 Company and the construction and operation of a new, approximately 30-mile (48-kilometer) dedicated pipeline (ranging from 6 to 12 inches [15.2 to 30.5 centimeters] in diameter) from the end of the Kinder Morgan line (near McCamey, Texas) to the injection well sites (Figures S-C and 2-C). Option 2 would require additional sulfur removal either at the FutureGen plant or in a separate sulfur removal plant operated by Kinder Morgan.***

Odessa originally proposed an option for transporting CO_2 in the existing Kinder Morgan CO_2 pipeline along with PetroSource's existing Val Verde pipeline and PetroSource's existing (but not currently operating) Comanche Creek pipeline that runs to the east side and the west side, respectively, of the proposed sequestration site. However, the existing Val Verde CO_2 pipeline, which runs to the east of the proposed sequestration site, could not be used to transport FutureGen CO_2 to the proposed sequestration site. The Val Verde pipeline carries CO_2 northwards, rather than southwards as would be required for the original proposal. Given PetroSource's current use of the Val Verde pipeline to carry CO_2 northwards, it would be infeasible to use this line to transport FutureGen CO_2 southwards to the proposed injection site.

Use of the existing Comanche Creek pipeline would require upgrades such as repairing or replacing sections of the pipeline or pipeline components. In addition, normal pipeline safety analysis and leak testing, similar to that conducted for new pipelines, would be required and conducted along the length of the pipeline. DOE calculations show that the existing Comanche Creek 6-inch (15.2-centimeter) pipeline would be sufficient to transport a maximum of about 1.1 million tons (1 MMT) of CO_2 per year, although two booster pumps would need to be installed about 25 miles (40 kilometers) apart along the line to maintain pressure (FG Alliance, 2007a). Power for the pumps would be supplied from two existing 69-kV transmission lines that intersect the Comanche Creek pipeline and substations that are located near the pipeline. Up to 10 miles (16 kilometers) of distribution lines from the substations to the pumps may be required. The pumps would likely be housed in a small shed (similar to a backyard shed, approximately 150 square feet [14 square meters]) which would contain the pump, controller, and electrical switchgear. The pump shed would be fenced and placed within the existing pipeline ROW.

Any new CO_2 pipelines would be constructed and operated by either Kinder Morgan CO_2 Company, Occidental Petroleum Corporation, PetroSource, or Trinity CO_2 LLC and would follow existing ROWs (short CO_2 pipeline spurs from the power plant site to the existing Kinder Morgan pipeline and from existing PetroSource CO_2 pipelines to the sequestration site were addressed in the EIS). Obtaining new pipeline ROW is a common occurrence in West Texas. The construction and operation of new CO_2 pipelines is not expected to have environmental impacts of a different nature, in addition to what has already been forecasted in the EIS because construction would occur within existing ROW and would traverse similar terrain as was analyzed in the EIS for the original proposal.

To use the existing Kinder Morgan CO_2 pipeline for Option 2 and the original proposal, additional sulfur would need to be removed from the CO_2 stream. If this option were to be selected, it would be likely that the FutureGen plant would be designed to provide for an additional scrubbing column to the Acid Gas Removal Unit and to increase the recirculation rate of the scrubbing solvent. No additional water treatment chemicals would be required for this additional column; the volume of elemental sulfur created by this process would increase by less than 3 percent over that which was described in the original proposal. For these reasons, no additional environmental impacts would be expected beyond those described in Section 7.16. If Kinder Morgan were to construct and operate a sulfur removal plant at the FutureGen power plant site (i.e., not part of the FutureGen plant), it would likely use solid metal oxide adsorbents in fixed beds to remove the sulfur from the CO_2.

For the removal of sulfur, there are a broad range of technologies available including guardbeds or molecular sieves. Byproduct generation and waste streams would likely be minimal and could be integrated with those from FutureGen operations and byproducts would be minimized. Potential byproducts include those similar to that from the FutureGen Claus plant (analyzed in this EIS) and perhaps zinc oxide if a guardbed is utilized. Where possible, adsorbent materials would be regenerated and byproducts and wastes minimized. Due to the relatively small amount of hydrogen sulfide in the feed stream (<100 parts per million [ppm]), waste quantities would be minimal compared to that in the power plant.

Odessa also proposed as an option "CO_2 swapping." Through this option, CO_2 generated by a FutureGen plant located in Odessa would be directed into the CO_2 pipeline owned by Kinder Morgan CO_2 Company where it would be transported and sold for enhanced oil recovery (EOR). CO_2 separated by natural gas processing plants located south of the proposed Odessa injection site would be transported northwards through the PetroSource Val Verde CO_2 pipeline and injected at the proposed Odessa injection site. Thus, while the goal for injection and storage of the CO_2 could be met, no CO_2 from the FutureGen plant would reach the injection site under this option. Both DOE and the Alliance have determined that this option would not meet one of the key purposes of the FutureGen project, which is to demonstrate the integration of a coal-fueled power plant with CO_2 capture and sequestration. For this reason, DOE has determined that this option is unreasonable and has eliminated it from further consideration in this EIS.

S.4.3.4 Potential Impacts of Proposed Odessa Pipeline Route Options

The affected environment and environmental impacts from construction of the new Odessa water and CO_2 pipeline options were assessed by evaluating several sources. These sources include review of aerial photographs (2005) and topographic maps (2005) for the area; the National Hydrology Dataset from the United States Geologic Survey (1999) for water bodies, streams/washes, and springs; the Texas Parks and Wildlife Department (2003) for vegetation; Soil Data Mart via the United States Department of Agriculture, Natural Resources Conservation Service for Soils (2007); National Wetland Inventory

(NWI) data for wetlands (2002); and ESRI Data and Maps (2005) for Census and traffic and transportation information.

The new Odessa water and CO_2 pipeline options would not require changes to sections of the EIS that address potential impacts to resources as there were no impacts from the construction or operations of the new pipelines options, under the following topical headings: Climate and Meteorology, Geology, Community Services, Socioeconomics, and Environmental Justice.

Table S-B briefly describes the potential impacts associated with the new Odessa water and CO_2 pipeline options presented in the BAFO.

Table S-B. Potential Impacts Associated with the New Odessa Process Water Pipeline and CO_2 Pipeline Options

Resource Area	*Relevance to the Potential Environmental Impacts*
	New Odessa Water Pipeline Option
Air Quality, Soils, Biological, Transportation and Traffic, and Noise and Vibration	***Under the new water pipeline option, impacts associated with these resource areas would be temporary, occurring during the construction phase and reduced or mitigated through best management practices (BMPs) discussed in Section 3.4, Table 3-13, and Table 3-14.*** ***Under Air Quality, emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_X), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs) from construction would be localized and temporary in nature and could cause minor to moderate short-term degradation of air quality in areas where pipeline construction is taking place.*** ***Soils would be temporarily disturbed during construction. No prime farmland soils were found in the vicinity of the proposed water pipeline.*** ***Wildlife species found along this corridor could be temporarily displaced during construction, but the land above the pipeline would be revegetated with native species after construction, maintaining wildlife habitat similar to current conditions.*** ***Minor disruptions to traffic could occur along one major and 47 minor roads during construction but would not create a substantial direct impact or long-term impact to traffic operations.*** ***Sensitive receptors in the vicinity of construction areas would temporarily experience elevated noise levels; however, such impacts would be minimal. Based on available data, 12 churches and 5 schools are located within a 1-mile (1.6-kilometer) ROI of the proposed water pipeline route.***
Groundwater (Use)	***Under this option, the CRMWD would supply water. The CRMWD currently owns and utilizes three reservoirs and four active well fields. Groundwater would only be used during the summer months to meet peak demands. Impacts to groundwater availability would be minimal as discussed in Section S.4.3.2.***
Surface Water (Use)	***Under this option, water would be required during construction for dust suppression and equipment washdown, and would most likely be trucked to areas where needed; no water would be withdrawn from local surface waters. Construction of the pipeline would disturb land along the water pipeline corridor, which could cause temporary indirect impacts to adjacent surface waters (for example, Monahans Draw) such as sedimentation and surface water turbidity from runoff. Impacts to surface water availability would be negligible as discussed in Section S.4.3.2.***

Table S-B. Potential Impacts Associated with the New Odessa Process Water Pipeline and CO_2 Pipeline Options

Resource Area	*Relevance to the Potential Environmental Impacts*
Wetlands and Floodplains	***NWI mapping indicates that at least one intermittent palustrine wetland (less than 8 acres [3.2 hectares]) located along the proposed water pipeline may be impacted under this option. Field verification would be required to confirm NWI mapping and to determine if any additional wetlands are present, and if so, the value of any wetlands occurring along the corridor. Any impacts would be reduced or mitigated through BMPs discussed in Section 3.4, Table 3-13, and Table 3-14. The alignment of the water pipeline could be modified to avoid the wetland or construction could be modified to reduce potential impacts.*** ***Based on available floodplain information, floodplains are present along the Odessa water pipeline option. However, temporarily adding or excavating fill during construction within the floodplain would have no permanent impact on the lateral extent, depth, or duration of flooding in the floodplain areas traversed. Any temporary impacts would be reduced or mitigated through BMPs discussed in Section 3.4, Table 3-13, and Table 3-14.***
Cultural Resources	***Within the ROI for the Odessa Site, the potential exists for cultural resources to be present. A Phase I survey would be needed to identify if any cultural resources exist along the water pipeline route, after the exact position of the route has been identified.***
Land Use	***Under this option, construction of the approximately 17-mile (27.6-kilometer) proposed water pipeline would have temporary, minor effects on land use during construction due to trenching, equipment movement, and material laydown. The ability to use some lands for their existing uses would be temporarily lost during construction. However, where the pipeline would be constructed in the existing ROW, long-term land use would not change. Where new ROW would be acquired, it is not anticipated that long-term land use would change, because this land is used as range land. The new, less than 1-mile (1.6-kilometer) section of the corridor would be within the same land use type as that found in the Texland corridor ROI.***
Materials and Waste Management	***Clearing of vegetation and grading during construction may create land debris that would require removal from the site. Construction debris disposal capacity is available at area landfills.*** ***Construction equipment would require fuel, oils, lubricants, and coolants. Should any of these require disposal, they would be appropriately managed and disposed of by the construction contractor.*** ***During normal operation, the water pipeline would not require additional materials and would not generate waste, other than cleared vegetation, if necessary, that could be disposed of at a non-hazardous waste landfill.***
Utility Systems	***No current information on utilities was available for the proposed water pipeline option. However, there is a potential for temporary impacts to underground utilities during construction.***

Table S-B. Potential Impacts Associated with the New Odessa Process Water Pipeline and CO_2 Pipeline Options

Resource Area	Relevance to the Potential Environmental Impacts
	New Odessa CO_2 Pipeline Options
Air Quality, Soils, Biological, Transportation and Traffic, and Noise and Vibration	***Under the new CO_2 pipeline Options 1 and 2, impacts associated with these resource areas would be temporary, occurring during the construction phase and reduced or mitigated through BMPs discussed in Section 3.4, Table 3-13, and Table 3-14.*** ***Under Air Quality, emissions of SO_2, NO_X, PM, CO, and VOCs from construction of Options 1 or 2 would be localized and temporary in nature and could cause minor to moderate short-term degradation of air quality in areas where construction is taking place.*** ***Soils would be temporarily disturbed during construction of pipeline Options 1 and 2. According to available data, no prime farmland soils were found in Crane, Crockett, or Ector counties. Prime farmland soils were found in Pecos County. However, it was not possible to determine if these soils are in the vicinity of the proposed new CO_2 pipelines based on available data.*** ***Wildlife species found along this corridor could be temporarily displaced during construction of pipeline Options 1 and 2. However, the land above the pipeline would be revegetated with native species after construction, maintaining wildlife habitat similar to current conditions.*** ***Minor disruptions to traffic could occur along up to 4 major and 119 minor roads during construction of pipeline Options 1 and 2, but would not create a substantial direct impact to traffic operations.*** ***Based on available data, no churches or schools were found adjacent to Options 1 and 2. Any additional sensitive receptors in the vicinity of construction areas would temporarily experience elevated noise levels; however, such impacts would be minimal.***
Wetlands and Floodplains	***An analysis of NWI maps indicates that 20 palustrine wetlands and 1 riverine wetland occur within the ROI near where the pipeline would cross the Pecos River for both Options 1 and 2. The palustrine wetlands range from 0.10 to 3.2 acres (0.04 to 1.3 hectares) in size, for a total of 15.9 acres (6.4 hectares). The size of the riverine wetland is not known, but potentially encompasses the whole length of the Pecos River segment within the ROI. These wetlands are directly associated with the Pecos River and nearby meander cutoffs formed by the river over time. After the precise pipeline location is determined, field verification would be required to determine if any jurisdictional wetlands are present and, if so, the value of the wetlands. Any impacts that could not be avoided by repositioning the pipeline location would be reduced or mitigated through BMPs discussed in Section 3.4, Table 3-13, and Table 3-14. If wetlands are present, the alignment of the pipeline could be modified to avoid the wetland or construction could be modified to reduce potential impacts.*** ***Based on available floodplain information, floodplains are present along the CO_2 pipeline for Options 1 and 2. However, temporarily adding or excavating fill during construction within the floodplain would have no permanent impact on the lateral extent, depth, or duration of flooding in the floodplain areas traversed. Any temporary impacts would be reduced or mitigated through BMPs discussed in Section 3.4, Table 3-13, and Table 3-14.***

Table S-B. Potential Impacts Associated with the New Odessa Process Water Pipeline and CO_2 Pipeline Options

Resource Area	***Relevance to the Potential Environmental Impacts***
Surface Water	***In both Options 1 and 2, the pipeline would cross the upper Pecos River (Segment 2311) near where the western tip of Crockett County meets Crane and Pecos counties. This segment was listed as impaired in the 2006 Texas Commission on Environmental Quality (TCEQ) 303(d) list due to depressed oxygen levels. Sediment loading is another concern for the Pecos River. Careful planning would be needed to minimize sediment impacts to the Pecos River during construction activities. [Reference: Draft Watershed Protection Plan for the Pecos River in Texas, Texas State Soil and Water Conservation Board http://pecosbasin.tamu.edu/wpp.php.***
Cultural Resources	***Within the ROI for the Odessa Site, the potential exists for cultural resources to be present. A Phase I survey would be needed to identify if any cultural resources exist along the proposed CO_2 pipeline for Options 1 and 2, after the exact position of the route has been identified.***
Land Use	***Under pipeline Options 1 and 2, construction of the CO_2 pipeline would have temporary, minor effects on land use during construction due to trenching, equipment movement, and material laydown. The ability to use some lands for their existing uses would be temporarily lost during construction. However, because the pipeline would be constructed in the existing ROW, long-term land use would not change.***
Aesthetics	***Under pipeline Option 2, the potential exists for visual impacts to receptors and travelers as a result of the sulfur removal plant at the FutureGen Power Plant or another location (currently unknown). Additionally, two booster pumps would be located somewhere along the CO_2 pipeline.***
Utility Systems	***No current information on utilities was available for the new CO_2 pipelines. However, there is a potential for temporary impacts to underground utilities during construction.***
Materials and Waste Management	***Clearing of vegetation and grading during construction may create land debris that would require removal from the site. Construction debris disposal capacity is available at area landfills.*** ***Construction equipment would require fuel, oils, lubricants, and coolants. Should any of these fluids require disposal, they would be appropriately managed and disposed of by the construction contractor.*** ***During normal operation, the CO_2 pipeline would not require additional materials and would not generate waste, other than cleared vegetation, if necessary, that could be disposed of at a non-hazardous waste landfill.*** ***For the removal of sulfur, there are a broad range of technologies available including guardbeds or molecular sieves. Byproduct generation and waste streams would likely be minimal and could be handled along with those from FutureGen operations. Potential byproducts include those similar to that from the Claus plant and perhaps zinc oxide if a guardbed is utilized. Where possible, adsorbent materials would be regenerated and byproducts/wastes minimized. Due to the relatively small amount of hydrogen sulfide in the feed stream (<100 ppm), waste quantities would be minimal compared to that in the power plant.***

Table S-B. Potential Impacts Associated with the New Odessa Process Water Pipeline and CO_2 Pipeline Options

Resource Area	*Relevance to the Potential Environmental Impacts*
Health and Safety	***Potential occupational health and safety risks during construction of the proposed new CO_2 pipelines are expected to be typical of the risks for this type of construction. Health and safety concerns include: the movement of heavy objects, including construction equipment; slips; trips; and falls; and the risk of fire or explosion from general construction activities. For the two options, the risks of construction accidents would be primarily a function pipeline length, assuming most other factors would be the same per unit length of pipeline for the two options. Option 1 (having three times greater new pipeline length than Option 2) presents about three times greater risks of construction accidents compared to Option 2. Both Options 1 and 2 would present several times greater risks than the construction of only the connector pipelines (from the power plant to the existing pipeline system and from the existing pipelines to the sequestration site) for the original option.*** ***The potential for an accidental release (i.e., puncture or rupture) to occur on a newly constructed CO_2 pipeline would be the same, per mile of pipeline, as that analyzed in the EIS and in the Risk Assessment. Assuming the spacing of emergency shut-off valves is the same for all options (5-mile [8-kilometer] spacing), the quantity of gas that could be released varies as a function of the inside diameter of the pipeline (ignoring small differences caused by small differences in pressure). If a new pipeline segment is built between McCamey station and the sequestration site, the use of a larger pipe diameter, such as 12 inches (30.5 centimeters) (e.g., Options 1 and 2) instead of 6 inches (15.2 centimeters) (e.g., original option, using the Comanche Creek pipeline), results in the potential release of a much larger quantity of gas (potentially 4 times as much) on this segment, compared to the original option using the Comanche Creek pipeline, unless the spacing of emergency shut-off valves is different.*** ***The Risk Assessment and this EIS present the analysis of a hypothetical 12.8 inch (32.5 centimeters) inside-diameter pipeline with a length of 61.5 miles (99 kilometers) located along a straight path from the proposed power plant site to the middle of the proposed sequestration site. This differs from Option 1 in that the pipeline length is about 30 percent less and in that the location is different. However, the terrain traversed (range land and arid lands) and the population densities within the region of potential effects (up to about 14,000 feet [4,267 meters] from the pipeline for adverse effects from hydrogen sulfide (H_2S) exposure after a pipeline rupture) are approximately the same. Population density (receptors) in the area surrounding the hypothetical straight-line pipeline route was examined in the Risk Assessment, and the population density is very low, representing the fact that this route traverses remote arid areas where few people live and where livestock density and wildlife densities are low. The proposed pipeline options likewise traverse remote arid areas of low population densities. The nearest town, Girvin, is outside the region of potential effects (more than 14,000 feet [4,267 meters] from the proposed pipeline routes).*** ***Including the use of existing pipelines for Option 2 and for the original option, all three options have approximately the same level of risks and potential impacts. A notable difference is that where a new pipeline would be constructed parallel to an existing pipeline and within the ROW of the existing pipeline, there would be a small risk of both pipelines being punctured or ruptured in the same accident. This risk would be much smaller than the risk of a single pipeline puncture or rupture, as presented in the Risk Assessment. Given the conceptual level information provided in the BAFOs, the Risk Assessment adequately addresses the magnitude and types of risks and potential impacts associated with the proposed project, given any one of the new pipeline options. The risks would remain small under any of the options.***

S.4.4 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

S.4.4.1 Site Screening and Selection Process

In accordance with the Limited Scope Cooperative Agreement with DOE, the Alliance developed siting criteria, issued a Request for Proposals (RFP), evaluated proposals received, and visited each proposed site. DOE reviewed Alliance activities at each step in the process to ensure fairness, openness, technical accuracy, and documentation. DOE also reviewed the process at each step to ensure that all reasonable alternative sites would be evaluated by DOE in the NEPA process.

The Alliance Siting Team developed criteria to select sites that could be considered for the FutureGen Project. Three types of criteria were established:

- Qualifying criteria – Criteria that each site would have to meet before being considered further - failure to meet any criterion resulted in disqualification;
- Scoring criteria – Criteria that would allow sites to be ranked based on the extent to which they possessed desirable features; and
- Best value criteria – Criteria that were not capable of being quantitatively scored, but that represented factors the Alliance would consider when choosing a site that could best fulfill the project mission.

The Alliance developed criteria for both the power plant (surface) and geologic storage (subsurface) components and later revised these criteria based on comments from subject-matter experts. The Alliance also sought, received, and considered input from outside stakeholders, including regulatory agencies and environmental groups, through selected interviews and comments received during the formal public comment period. DOE reviewed the rationale and participated in meetings to discuss each criterion before the Alliance published the draft RFP for public comment. The criteria are found in the Alliance *Request for Proposals for the FutureGen Facility Host Site* (http://www.futuregenalliance.org/news/futuregen_siting_final_rfp_3-07-2006.pdf) (FG Alliance, 2006a) and in the *Results of Site Offeror Proposal Evaluation* report ***(http://www.futuregenalliance.org/publications/fg_proposal_evaluation_report.pdf)*** dated July 21, 2006 (FG Alliance, 2006b).

The qualifying, scoring, and best value criteria were included in a draft RFP that the Alliance posted to its website (FG Alliance, 2006a) on February 14, 2006, for public review and comment. The Alliance accepted comments regarding the draft RFP until February 28, 2006. The final RFP was posted to the Alliance website on March 7, 2006. After receiving, posting, and responding to clarifying questions the Alliance posted minor amendments to the final RFP on March 20 and 24, 2006, with a deadline for proposal submittals of May 4, 2006.

Twelve proposals were submitted:

- Illinois – Effingham Site
- Illinois – Marshall Site
- Illinois – Mattoon Site
- Illinois – Tuscola Site
- Kentucky – Henderson County Site
- North Dakota – Bowman County Site
- Ohio – Meigs County Site
- Ohio – Tuscarawas County Site
- Texas – Heart of Brazos Site (near Jewett, Texas, and referred to in this EIS as Jewett)
- Texas – Odessa Site
- West Virginia – Point Pleasant Site
- Wyoming – Gillette Site

Two Evaluation Teams for the Alliance consisting of outside experts examined each proposal against the qualifying criteria. One team evaluated the plant site criteria, and the other evaluated the sequestration site criteria. Based on their reviews, the Evaluation Teams determined that four sites did not satisfy all of the qualifying criteria. The Alliance Board of Directors reviewed this conclusion and voted to exclude the four sites from further consideration. The four sites that did not meet all of the qualifying criteria were the Bowman County Site, Meigs County Site, Point Pleasant Site, and Gillette Site.

After critical evaluation of the remaining eight sites, the Evaluation Teams tabulated scores for each site and a final score was derived for each scoring criterion for each site. Ranked lists of sites for both the power plant and the geologic storage area were generated and combined to develop a ranked list of qualified sites. The summaries for this scoring process are found in the Alliance report *Results of Site Offeror Proposal Evaluation* dated July 21, 2006 (FG Alliance, 2006b). Site visits were conducted in late May 2006.

Of the eight sites that met all of the qualifying criteria, three scored substantially lower than the others, taking into account the results of both the power plant site and the sequestration site scoring criteria. Overall, these three sites achieved relatively low scores in the following areas and were excluded from further consideration:

- Proximity to sensitive areas;
- Distance to transmission lines and to transportation for material and fuel delivery;
- Penetrations of secondary seals for the target formation;
- Target formation properties, especially the extent of the plume area and the number of wells needed to meet the injection target;
- Ability to meet monitoring, mitigation, and verification (MM&V) requirements; and
- Additional regulatory requirements that would be imposed.

The Alliance also determined that one of the remaining five top-scoring sites posed substantial problems for construction given its relatively small size and the configuration of the site. Experts in power plant siting concluded that it would be difficult to construct a rail loop for coal delivery at the proposed site. This site was also located close to residential areas, which raised land use compatibility concerns, and it was subsequently eliminated.

DOE reviewed the Alliance's report on the selection process (FG Alliance, 2006b) for fairness, technical accuracy, and compliance with the established approach. DOE concluded that the process met these requirements and determined that the Alliance's Candidate Site List, including the four sites described in Section S.4.2, is the appropriate list of reasonable alternative sites for detailed analysis in this EIS.

S.4.4.2 Technology Options Eliminated from Further Consideration

Pursuant to the President's FutureGen Initiative, DOE determined that all project alternatives must use coal as fuel, produce electricity, produce H_2, meet very low target emission rates, and capture and store emissions of GHGs. Therefore, DOE determined that reasonable alternatives would not include:

- Super-critical pulverized coal power plant technology (which cannot produce significant quantities of H_2 without suffering an unreasonably large efficiency penalty).
- Integrated gasification fuel cell power plant technology (for which risk levels are considered too high given that fuel cells are not sufficiently developed at the size required for this project).
- Nuclear power plant technology (which does not use coal and does not allow an opportunity to demonstrate the capture and storage of GHG emissions).

- Renewable resource technologies, including wind power, wave power, geothermal energy, solar energy, and biomass combustion (which do not use coal and do not allow an opportunity to demonstrate the capture and storage of GHG emissions).
- Energy efficiency improvement technologies.

Many of the technologies eliminated from consideration are addressed by other programs and projects in DOE's diverse portfolio of energy research, development, and demonstration efforts. These technologies, along with increasing energy efficiency, complement the goals of the FutureGen Project to help reduce emissions of CO_2 and other GHGs.

Geologic sequestration was identified as a reasonable alternative for meeting the requirement of reduced GHG emissions. Other sequestration alternatives considered, but eliminated include:

- Deep ocean sequestration – Deep ocean sequestration is the deliberate injection of captured CO_2 into the ocean at great depths where it could potentially be isolated from the atmosphere for centuries (IPCC, 2005). This technology currently exists; however, the knowledge base is inadequate to determine what biological, physical, or chemical impacts might occur from interactions with the marine ecosystem.
- Terrestrial sequestration – Terrestrial sequestration is the process of atmospheric CO_2 absorption by trees, plants, and crops through photosynthesis and storage as carbon compounds in biomass (tree trunks, branches, foliage, and roots) and soils. While terrestrial sequestration may be an attractive and useful sequestration option, the uncertain long-term accountability and permanence of CO_2 storage and the inability to directly store the CO_2 captured from power plants makes this option unlikely to be implemented in the electrical power industry (NETL, 2007).
- Mineral sequestration – Mineral sequestration is the process of reacting CO_2 with metal oxide-bearing materials (typically minerals like forsterite or serpentine) to form insoluble stable carbonates, with calcium and magnesium being the most commonly used metals (IPCC, 2005). The main challenge for mineral sequestration is developing a commercial process for reaction of the naturally occurring minerals with CO_2 to form carbonates. Even though the reaction is thermodynamically favored, it is extremely slow in nature, and therefore, its economic viability is uncertain (Herzog, 2002).

DOE also considered but eliminated the alternative of attaching CO_2 capture devices and sequestration facilities to an existing or planned commercial power plant. Such an approach could meet the FutureGen Project's objectives without the cost of planning, designing, and building a new power plant. However, this alternative was eliminated for the reasons detailed below.

- Existing or planned non-IGCC power plants – Almost all non-IGCC power plants are not sufficiently pressurized to reduce the efficiency penalty associated with capture and compression of CO_2. In addition, these plants cannot produce appreciable quantities of H_2 without suffering an unreasonably large efficiency penalty when using the produced electricity to generate H_2 (e.g., by electrolysis).
- Existing or planned IGCC power plants – Owners of these plants have not volunteered their existing or planned IGCC power plants for the FutureGen Project. Existing plants would not be able to accommodate equipment for pre-combustion capture of CO_2 from synthesis gas without extensive modification, and would not have the necessary features that create a research platform to meet the FutureGen Project's research, development, and demonstration objectives.

Owners of existing and planned power plants, including IGCC plants, would not accept the financial and operational risks associated with adding CO_2 capture devices and experimental geologic sequestration to their plants. Commercial ventures generally cannot accept the intensive testing and interruptions of power generation that would be associated with the research and development activities of the FutureGen Project. Commercial operators are bound by power purchase agreements that are unforgiving of delivery failures, and the power market does not offer much flexibility in negotiating the terms and conditions in these agreements. While the idea of "attaching" the FutureGen Project to an existing or planned IGCC power plant is technically feasible, it is unreasonable from a business perspective.

On April 21, 2003, DOE published a Request for Information in the *Federal Register* (68 FR 19521) openly inviting expressions of interest from organizations capable of implementing the FutureGen Project. Only one qualifying group (the Alliance) submitted an expression of interest. No existing or planned power plant operators offered to modify their plants to achieve FutureGen goals.

To meet the FutureGen Project objectives, DOE requires advancements in the facility's design, experimentation in a near-laboratory setting (including experimentation in a test platform), and operational technology development (at a full scale and at a reduced scale in available side streams and slip streams). These advancements would be more appropriate for a research platform such as the FutureGen Project, rather than an existing commercial power plant.

S.4.5 *PREFERRED ALTERNATIVE*

DOE's preferred alternative is to provide financial assistance to the FutureGen Project, assuming that one or more sites would be found acceptable in the ROD. DOE tentatively finds all four sites to be acceptable. If DOE ultimately selects the preferred alternative (to grant financial assistance to implement the FutureGen Project at any of the four sites), DOE would then determine for each site whether mitigation of specified potential impacts would be required. DOE is also free, however, to ultimately determine in the ROD that fewer than all four sites are acceptable, or to select no action.

S.5 PUBLIC SCOPING AND PUBLIC HEARINGS

S.5.1 PUBLIC SCOPING AND COMMENTS

DOE published the NOI in the *Federal Register* on July 28, 2006 (71 FR 42840) to initiate public scoping to start the NEPA process and to identify the most important issues and concerns to be addressed in this EIS. Figure S-15 illustrates the steps in the NEPA process. During the public scoping period, DOE solicited public input to ensure that (1) significant issues would be identified early and be properly studied; (2) issues of minimal significance would not consume excessive time and effort; and (3) the EIS would be thorough and balanced. Both DOE and the Site Proponents consulted with various interested governmental agencies to further define the scope of the EIS. Additionally, EPA staff reviewed and provided input to DOE's plan for conducting a risk assessment of underground storage of CO_2, participated in the development of the site selection criteria used in the solicitation and evaluation of the site proposals, and reviewed and commented on the preliminary version of ***the*** Draft EIS.

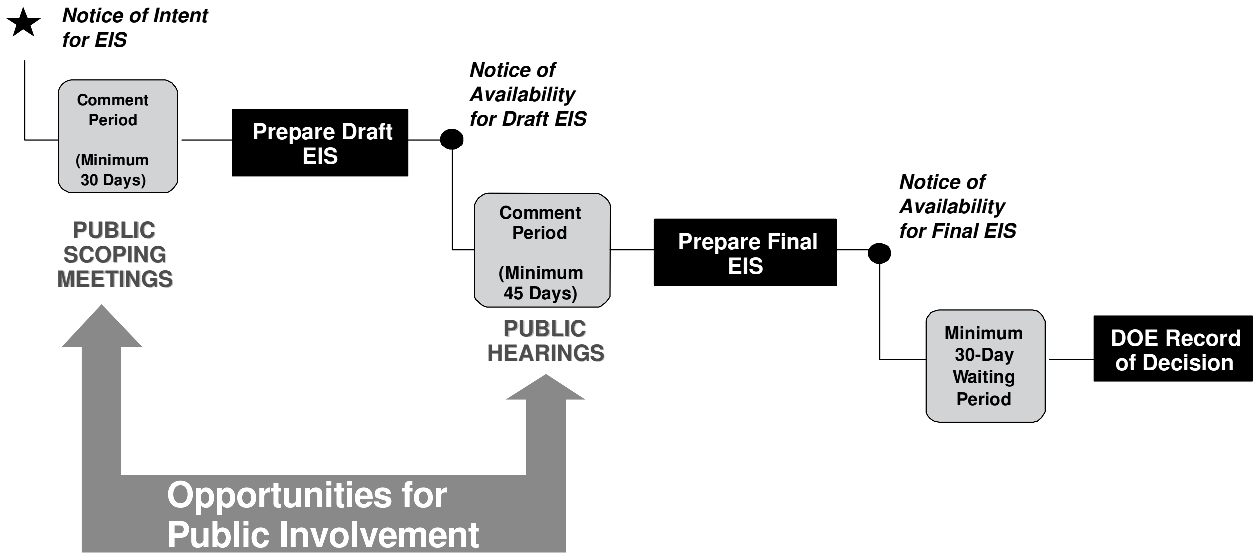


Figure S-15. Steps in the NEPA Process

DOE published a Notice of Public Scoping Meetings in the *Federal Register* on August 4, 2006 (71 FR 44275) and published notices in local newspapers announcing the meeting locations and times during the weeks of August 13, 20, and 27, 2006. Four public scoping meetings were held for the FutureGen Project EIS with one near each of the alternative sites. The public scoping period ended on September 13, 2006, after a 47-day comment period.

DOE accommodated several methods for submitting comments on the scope of the EIS. A court reporter was present at each meeting to ensure that all spoken comments during the formal meeting were recorded and transcribed. In addition, anyone who wished to give comments in writing was invited to do so at the public scoping meetings by completing a comment card and submitting it to DOE at the meeting. DOE also offered an e-mail address, a postal address, a facsimile number, and a toll-free telephone number. In all, respondents submitted ***406*** comments via e-mail, mail, facsimile, telephone, or formal oral comment at the public meetings.

The majority of the comments were related to the use of natural resources (e.g., coal, land, and water), the discharge of pollutants to the natural environment (e.g., air and water), and the socioeconomic impacts of the project (e.g., jobs, taxes, and property values). Table S-5 lists the composite set of issues identified during public scoping for consideration in the EIS. Issues are discussed and analyzed in this EIS in accordance with their relative importance. The most detailed analyses focused on air quality, water resources, noise, and human health, safety, and accidents.

Table S-5. Issues Identified during Public Scoping

Purpose and Need
• Demonstration of need for the proposed project. • Consideration of alternatives such as wind or solar power, energy conservation.
Environmental Resources
• Air Quality: Potential impacts from air emissions (including mercury, VOCs, and particulate matter [PM]) during construction and operation of the power plant and impacts to sensitive receptors. Impacts of dust from construction, transportation, and storage of materials. Potential impacts on National Ambient Air Quality Standards (NAAQS). • Geology and Soils: Potential for activation of surface or subsurface faults. Potential for seismic activity from

Table S-5. Issues Identified during Public Scoping

carbon sequestration.
• Water Resources: Potential impact to drinking water supplies and freshwater aquifers. Potential impacts to surface water and groundwater flow and to water resources from wastewater discharge or runoff.
• Wetlands and Floodplains: Potential impacts to wetlands and floodplains.
• Ecological Resources: Potential on-site and off-site impacts to vegetation, terrestrial and aquatic wildlife, threatened and endangered species, and ecologically sensitive habitats.
• Cultural Resources: Potential for impacts to Native American cultural resources.
• Land Use: Potential impacts to prime farmland and conversion of land use from farming to industrial use. Use of site after plant closure. Property rights to store CO_2 under adjoining property.
• Aesthetics: Impacts on viewsheds to residences, including views of transmission lines.
• Transportation and Traffic: Potential impacts to local traffic patterns, safety at railroad crossings, and traffic controls. Transportation and roadway infrastructure impacts from rail and truck transport of coal to the plant. Need for upgrades or improvements to local roadway infrastructure.
• Noise and Vibration: Noise levels generated from the unloading of coal from railcars and switching the train cars. Impacts to sensitive receptors from increased noise levels.
• Materials and Waste Management: Impact of accumulating piles of ash/slag and sulfur generated by the gasification process. Reuse or disposal of byproducts of the coal gasification process. The method and location by which solid and hazardous waste would be disposed, including mercury containing materials and ash/slag.
• Human Health, Safety, and Accidents: The potential danger of an explosion at the plant to local community and the community safety measures that would be taken. The potential danger of a terrorist attack. Potential impact of electromagnetic fields on people who live near the proposed transmission lines, substations, and transformers.
• Risk Assessment: Development of a monitoring program of the carbon sequestration to detect leaks from the carbon sequestration system and a maintenance program to repair leaks. Potential for a catastrophic release and the actions that would be taken in the event of a release. Potential for carbon sequestration to reverse subsidence. Potential for releases through oil, gas, or water wells to the aquifer system and potential impacts to these existing wells. Stress limits of the CO_2 injection system and prediction of when CO_2 migration will stop in relation to property boundaries on the surface. Potential for sequestered CO_2 to impact drinking water sources and the risk of movement between aquifers or into the atmosphere.
• Community Services and Socioeconomics: Socioeconomic impacts on local job market, taxes, and impacts to property values, and commercial and residential growth. Use of the power plant after DOE involvement has ended. Impacts to emergency services (e.g., police and fire support).
Cumulative Impacts
• Cumulative Impacts: Potential cumulative impacts that could result from the incremental impacts of the proposed project when added to the other past, present, and reasonably foreseeable future projects.

DOE has addressed all substantive comments in this EIS. However, some comments received are outside the scope of this EIS. For example, several respondents indicated that the EIS should include alternatives such as the utilization of renewable energy resources (e.g., wind and solar power). Because the particular goal of the FutureGen Project is to demonstrate an advanced power generation facility based on fossil fuels, specifically coal, technologies that would not be based on coal use are not within the scope of this EIS. However, DOE oversees numerous programs that are investigating and supporting a wide variety of energy generation technologies, including many based on renewable sources, as well as programs that promote energy conservation. Questions were also raised regarding the environmental and safety impacts of coal mining. However, coal is a commercial fuel produced by a regulated industry. There would be no change in nationwide coal production; therefore, there should be no change in environmental impacts to mining. Hence, DOE considers that the environmental and safety impacts of coal mining are outside the scope of this EIS.

S.5.2 *PUBLIC HEARINGS AND COMMENTS*

DOE announced the availability of the Draft EIS in a NOA published in the Federal Register on June 1, 2007. During the comment period (June 1, 2007 to July 16, 2007), the DOE held four public hearings for the FutureGen Project Draft EIS. The hearing locations were selected based on their close proximity to the alternative site locations in Texas and Illinois. Three of the four hearings were in the same locations as the scoping meetings. The public hearings were announced in the June 1, 2007, Federal Register notice. In addition, DOE published notices in local newspapers during the weeks of June 11, 18, and 25, 2007.

Comments on the Draft EIS were received during the comment period via telephone, fax, e-mail, and mail. In addition, comment forms were completed and given to DOE during the public hearings. Oral comments were also given and transcribed at each of the public hearings.

Each public hearing began with an informal open house from 4:00 to 7:00 pm (Central Daylight Saving Time) during which time attendees were given information packages about the project and were able to view project related posters. DOE FutureGen Project personnel were available to answer questions. Representatives of the Alliance and local representatives were also available at displays illustrating various features of the proposed project and proposed sites.

The informal open house was followed by a formal DOE presentation and the formal public hearing. Collectively, 554 individuals attended the public hearings; a few individuals attended more than one meeting.

DOE led the presentations and presided over the four formal meetings. A court reporter was present at each meeting to ensure that all oral comments were recorded and transcribed. A total of 60 individuals presented oral comments. In addition, individuals could request to receive the Draft EIS and/or the Final EIS, or Summary (either a hard copy or a hard copy summary plus a CD containing the entire EIS).

Anyone who wished to provide comments in writing was invited to do so by completing a comment card and giving it to a DOE FutureGen Project Team member at the public hearing or mailing in a postcard format comment card at a later date. DOE also provided an e-mail address for members of the public who preferred to submit their comments electronically, a postal address for those who preferred to mail their comments, a telephone fax number for those who preferred to fax their comments, and a toll-free telephone number for those who preferred to provide spoken comments.

In preparing the Final EIS, DOE considered all comments to the extent practicable. An identification number was assigned to each originator of comments (i.e., per commentor) including those verbally expressed at the public hearings. A total of 175 individuals and organizations provided comments on the Draft EIS. A majority of the comments received stated support for the project.

S.6 SUMMARY OF MAJOR CHANGES IN THE EIS

Comments received on the Draft EIS are detailed in Volume III, Chapter 13 (Comments and Responses on the Draft EIS). DOE has responded to these comments and addressed them in the Final EIS, as appropriate. A summary of the major comments and revisions in the EIS is provided as follows:

***Preferred Alternative* – DOE identified its Preferred Alternative, to provide financial assistance to the FutureGen Project, in the Summary, Section S.4.5 and Volume I, Chapter 2, Section 2.4.8.**

***Public Hearings Summary* – A detailed discussion of the public hearings held in June 2007 is provided in Volume III, Chapter 13, and is summarized in the Summary, Section S.5.2 and in Volume I, Chapter 1, Section 1.7.**

***New Options for Matoon Water Pipeline and Odessa Water and CO_2 Pipelines* - To complete the site proposal process, the Alliance offered an opportunity for the Site Proponents to submit BAFOs on their proposals. Pursuant to directions from the Alliance, the four alternative Site Proponents submitted BAFOs to the Alliance on August 1, 2007.**

The Mattoon and Odessa Site Proponents provided additional water and CO_2 pipeline options for the Alliance to consider in its final siting selection. Neither the Tuscola nor Jewett Site Proponents put forward additional options for consideration that might have potential environmental impacts. Other information provided by the Site Proponents in their BAFOs relates solely to potential business arrangements between the Alliance and the Site Proponents.

The new Mattoon and Odessa options were not described in the Draft EIS. Nevertheless, as variations of the alternatives in the Draft EIS, DOE considered the potential environmental consequences in the Final EIS. The new text is provided in the Summary in Section S.4.3 and in Volume I, Chapter 2, Section 2.4.5.

***Odessa Pipeline Option* – Since issuance of the Draft EIS, Alliance and DOE investigations have revealed that it would not be feasible at this time to transport CO_2 from the proposed power plant site at Odessa to the proposed injection well site using the PetroSource Val Verde CO_2 pipeline located east of the injection site, as stated in the Draft EIS. Therefore, in its BAFO, Odessa has offered two additional CO_2 pipeline options.**

Text describing the new Odessa CO_2 pipeline options has been added to the Final EIS in the Summary (Section S.4.2.4, Table S-4), Volume I, Chapter 2 (Sections 2.4.4 and 2.4.5) and in Volume II, Chapter 7 (Section 7.1.3, Table 7.1-1).

***Continuous Monitoring Methods* - Public concerns were raised regarding monitoring of the injection of CO_2. A new subsection titled Continuous Monitoring Methods was added to Section 2.5.2.2, Monitoring, Mitigation, and Verification in the Final EIS that describes various monitoring systems that could be implemented. Such systems could include a Supervisory Control and Data Acquisition (SCADA) system to continuously monitor and transmit flow rate, pressure, and temperature information from the injection wells to a central data collection point; Eddy Covariance tower(s) to measure atmospheric CO_2 concentrations; detectors installed at the wellheads; and the use of micro-tiltmeters and monitoring wells.**

***Noise Monitoring* – Commentors stated they had concerns about noise levels related to the operation and construction of the FutureGen Project and increased traffic during construction and operation. DOE collected additional noise monitoring information in June 2007 at each of the four alternative site locations. DOE used the Federal Highway Administration's (FHWA's) Traffic Noise Model, Version 2.5, which considers roadway geometry, vehicle speed, and traffic direction, to predict the increase in noise generated by project-related construction and operation activities. The noise analysis was conducted to evaluate the impacts at mobile source receptors whenever the 3-dBA threshold was exceeded. The results of the noise monitoring conducted in June 2007 are provided in**

the Summary, Table S-12; Volume I, Chapter 3, Section 3.1.14 and Table 3-3; and in Volume II, Sections 4.14, 5.14, 6.14, and 7.14 of the Final EIS.

<u>Potential for Release during Co-Sequestration of CO_2 and H_2S</u> - Additional model simulations of pipeline ruptures or punctures to represent releases during the co-sequestration experiment were conducted and the results are discussed in the revised Risk Assessment report and the Final EIS in Volume I, Chapter 3, Section 3.1.17.

<u>Cumulative Impacts – Air Quality</u>- Comments were received about the inclusion of emission sources in the vicinity of the Jewett Site that would contribute to cumulative impacts to air quality, particularly power plants that are no longer being considered. Based on comments from the regulators, the following projects were deleted from cumulative air impacts: Big Brown, Lake Creek, and Trading House Units 3 and 4. Text was revised in the Final EIS in the Summary, Section S.10.2, Table S-14; and in Volume I, Chapter 3, Section 3.3.3.2, Table 3-7.

<u>Cumulative Impacts - Water Supply</u> – Public concerns were raised about this project causing cumulative impacts to water supply resources at the alternative site locations. Revised text that more fully explains the water supply sources and the potential demand on water supply sources was added to the Final EIS in the Summary, Section S.10.3, and Volume I, Chapter 3, Section 3.3.4.

<u>Radionuclides and Radon</u> – DOE received a comment concerning radioactive isotopes in coal. New text was added to Volume II, Chapters 4, 5, 6, and 7 in the air quality sections 4.2, 5.2, 6.2, and 7.2 of the Final EIS that describes the components of coal, the potential for radionuclide emissions (both parent elements and various decay products) from coal-fired boilers, the fate and transport of radionuclides in a coal combustion power plant, and the proposed use of extremely high particulate control at FutureGen compared to conventional coal plants.

<u>Alternative Power Sources</u> – Several commentors questioned why other sources of power such as wind or solar energy were not being considered in place of coal power. The comment-response document in Volume III, Chapter 13 responds to this general comment as follows (no change was made to the EIS):

> ***DOE oversees numerous programs that are investigating and supporting a wide variety of renewable energy generation technologies, including wind, solar, and hydro. However, the particular goal of the FutureGen Program is to demonstrate an advanced power generation facility based on fossil fuels, specifically coal. Hence, technologies that would not be based on coal use are not within the scope of the FutureGen Project.***

<u>Comments and Responses on the Draft EIS</u> – Volume III, Chapter 13 contains copies of all comments that were received by DOE on the Draft EIS. Individual responses to comments are provided in Volume III, Chapter 13.

<u>Risk Assessment Report</u> – Additional model simulations of pipeline ruptures or punctures to represent releases during the co-sequestration experiment were conducted, as discussed in the revised Risk Assessment. These results show that the distance where the public could be exposed to H_2S at levels that could result in adverse effects is significantly greater than for the base case, and thus more people could be exposed, if a release occurred during an experiment. A summary of the risk results for the co-sequestration experiment is found in the Risk Assessment Report, Section 4.5.5. Details on the modeling for the experiment are found in Appendix C, Section C.5, and C.6 of the report.

S.7 THE FUTUREGEN PROJECT

The FutureGen Project is in the early stages of design and, although the major features of the project are known, many engineering and planning details are still in the development phase. The Alliance developed reference design information and bounding conditions for use in this EIS. Where appropriate, design uncertainties and bounding conditions used are identified in this EIS. When specific process information that is needed for an analysis is not yet available, bounding conditions are used in this EIS. As the conceptual design work progresses, the Alliance would make decisions on the incorporation of specific technologies consistent with the overall project goals and DOE's ROD. As discussed in Section S.1.3, DOE will prepare a Supplement Analysis to determine if there are substantial changes in the Proposed Action or significant new circumstances or information relevant to environmental concerns.

S.7.1 *POWER PLANT AND RESEARCH FACILITY*

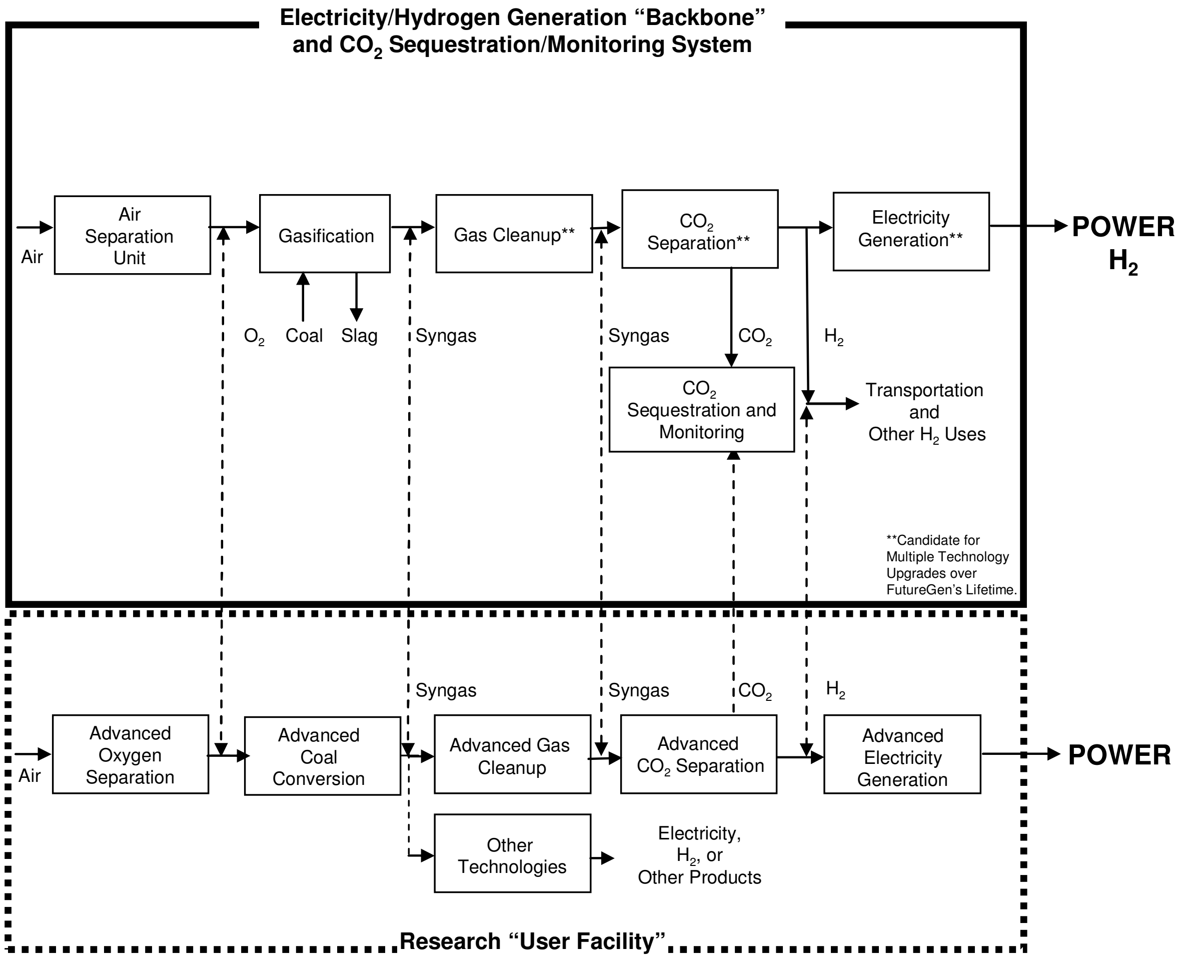
The FutureGen power plant would be a 275-MW output IGCC system. The major components of this system are illustrated in Figure S-16.

Planned research, development, and testing activities (see Figure S-17) would use all elements of the facility, including the backbone power generation train, an optional side-stream power train, a sub-scale test platform (or test bay), and the CO_2 sequestration facility located outside the power plant. In addition to research and development on power plant technologies, the FutureGen Project could serve as the premier platform for testing and deploying new technologies related to CO_2 storage, retention, and monitoring, and for developing a critical understanding of reservoir structure, chemistry, and performance (see Section S.7.1.1).

The "backbone" refers to the equipment train necessary to fulfill the major objective of the FutureGen Project: commercial-scale power generation with a minimum of 1.1 million tons (1 MMT) of CO_2 captured and stored per year. The facility's test platform and optional side-stream power train would enable full-scale module testing as well as sub-scale testing of new components and systems using syngas, H_2, or other chemicals produced by the facility. Although design and construction of the facilities required to allow such testing to occur are part of the Proposed Action, the use of the test platform would be funded outside the scope of the FutureGen Cooperative Agreement. Prototype testing of advanced technologies would be considered in the following areas:

- Fuel Processing Power Plant – Electric power production, hydrogen production, and carbon capture.
  - Coal feed
  - Oxygen supply (air separation)
  - Syngas preconditioning
  - Syngas cleaning
  - CO_2 removal/separation
  - Power systems
  - Water management
- Carbon Sequestration
  - Power plant/sequestration integration
  - Monitoring and mitigation
  - Reservoir modeling and science
  - Sequestration of hydrogen sulfide (H_2S) gas with CO_2

The key features of the FutureGen Power Plant design are summarized in Table S-6 and an example plant layout is illustrated in Figure S-18.



Source: Adapted from FG Alliance, 2007***b***.

Figure S-17. FutureGen Power Plant Overview

Table S-6. FutureGen Power Plant Features

Plant Feature	Process Description
Coal Handling Equipment	Equipment used for an IGCC plant is largely the same as that used at a conventional coal-fueled power plant. Coal would be transported to the facility by rail and stored on site in two piles, each providing a 15-day supply, or as one long coal pile of similar size. The coal would be crushed or pulverized before being fed into the gasification system.
Air Separation Unit (ASU)	The FutureGen Project would most likely be a high-pressure oxygen gas (O_2)-blown facility. O_2-blown gasification requires supplying a stream of compressed O_2 gas (rather than air) to the gasifier. O_2 would be generated in an ASU operating at very low temperature (cryogenic).
Gasifier	Operating at high temperatures (2,000 to 3,000 degrees Fahrenheit (°F) [1,093 degrees Celsius (°C) to 1,649°C]) and elevated pressures (400 to 1,000 pounds per square inch (psi) [2,758 to 6,895 kPa]), the gasifier combines coal, O_2, and steam to produce an H_2-rich synthesis gas (syngas). The product stream would consist mostly of H_2, CO, steam, and CO_2. Steam from the process would be condensed, treated, and recycled into the gasifier or added to the plant's process water circuit.

Table S-6. FutureGen Power Plant Features

Plant Feature	Process Description
Syngas Cooling	Syngas is cooled from around 2,000°F (1,093°C) to below 1,000°F (538°C), and the heat is recovered. Cooling is accomplished using a waste heat boiler or a direct quench process that injects either water or cool, recycled syngas into the raw syngas. When a waste heat boiler is used, steam produced in the boiler is typically routed to the heat recovery steam generator (HRSG) to augment steam turbine power generation.
Syngas Conditioning	Process involves removing particulate matter, converting CO in syngas to CO_2 (shifting), and capturing sulfur, nitrogen, and other chemical compounds from the syngas before it is input to the combustion turbine. Particulate removal is accomplished using either barrier filters or by water scrubbers located downstream of the cooling devices. The particulate matter, including char and fly ash, is typically recycled back to the gasifier. Once filtered and cooled, the syngas is treated in two-stages of clean up (called acid gas removal [AGR]); the first stage separates H_2S and mercury (Hg) and the second stage separates the CO_2 and produces a concentrated stream of H_2. The H_2S would be diverted to the sulfur recovery unit (SRU) (e.g., Claus process). Hg would likely be removed using activated carbon beds.
Combined Cycle Power System	After cleanup, the concentrated syngas flows to the combined cycle power system. In a combined cycle system, the first cycle involves the combustion of the primary syngas or H_2 fuel in a combustion turbine. The combustion turbine powers an electric generator and may also compress air for the ASU or gasifier. Hot exhaust gases are directed to a HRSG, which produces steam. For the second cycle, the steam drives a steam turbine to produce additional electricity. The two electricity generation systems, one with a combustion turbine and the other with a steam turbine, constitute the combined cycle power system and generate more electricity than older conventional systems that only use a steam turbine.
Flare	A flare is used to combust syngas during normal startups and unplanned restarts due to plant upsets. The flare would have a single stack and a single flame. The stack height would be up to 250 feet (76 meters), and the flare would be designed for a minimum 99 percent destruction efficiency of CO and H_2S.
Cooling Towers	Process would likely consist of a mechanical draft cooling tower combined with a convective heat removal system. Most of the water appropriated for the power plant would be consumed by evaporative cooling. A hybrid wet/dry cooling tower may be used to save water.
Zero Liquid Discharge (ZLD) System	Cooling tower blowdown (i.e., water removed from the cooling system) would be routed to the ZLD system to remove solids and dissolved constituents before reuse in the cooling tower. The ZLD process would first remove suspended solids in a clarifier, concentrate the dissolved solids using a reverse osmosis system, and then remove water from the dissolved solids through heating and vaporization. The ZLD process results in a solid filter cake material, which would be collected and transported off site for proper disposal.

S.7.1.1 Technology Options and Bounding Conditions

To support this EIS, the Alliance, in consultation with DOE, developed an initial conceptual design, which includes reference information for use in the impact analyses in this EIS. To develop bounding conditions, a range of outputs was developed based on the three technology cases summarized in Table S-7. To provide a conservative assessment of impacts, the assumptions and quantities (particularly air emissions, other waste streams, and land impacts) relate to the upper bound of the range of potential impacts. For example, the upper bound for air emissions was derived by assuming facility operations would result in the highest emission rate of individual pollutant species (e.g., NO_X) selected from among all three cases. Therefore, while used to develop the performance boundary, the aggregate upper bound is worse than any single technology case under consideration.

Table S-7. Power Plant Technology Cases under Evaluation for the FutureGen Project

Process or Component	Case 1	Case 2	Case 3	
			Unit A[1]	Unit B
Combustion Turbine	Frame 7FB	Frame 7FB	Frame 7FB	SGT6-3000
Gasifier Technology	Entrained Flow with Water Quench	Entrained Flow with Water Quench	Entrained Flow with Water Quench	Transport
Oxidant	95 mole percent Oxygen	95 mole percent Oxygen	95 mole percent Oxygen	TBD mole percent Oxygen
ASU	Cryogenic	Cryogenic	Cryogenic	Ion Transport Membrane
Coal	Pittsburgh Illinois PRB	Pittsburgh Illinois PRB	Pittsburgh Illinois PRB	Pittsburgh Illinois PRB
Coal Feed	Slurry	Dry	Slurry	Dry
H_2S Separation	Physical Solvent 1st Stage	Physical Solvent 1st Stage	Physical Solvent 1st Stage	Chemical Solvent
Sulfur Removal (minimum)	99 percent	99 percent	99 percent	99 percent
Sulfur Recovery	Claus Plant/ Elemental Sulfur	Claus Plant/ Elemental Sulfur	Claus Plant/ Elemental Sulfur	Claus Plant/ Elemental Sulfur
CO_2 Separation	Physical Solvent 2nd Stage	Physical Solvent 2nd Stage	Physical Solvent 2nd Stage	Physical Solvent 2nd Stage
CO_2 Capture (minimum)	1 million tpy (0.9 million mtpy), 90 percent	1 million tpy (0.9 million mtpy), 90 percent	1 million tpy (0.9 million mtpy), 90 percent	1 million tpy (0.9 million mtpy), 90 percent
CO_2 Sequestration	Plant Gate, 2200 psig(15,168 kPa)	Plant Gate, 2200 psig (15,168 kPa)	Plant Gate, 2200 psig (15,168 kPa)	Plant Gate, 2200 psig (15,168 kPa)
H_2 Production	835 lb/h (378.7 kg/h) at 100 percent purity	835 lb/h (378.7 kg/h) at 100 percent purity	835 lb/h (378.7 kg/h) at 100 percent purity	None

[1] Case 3A differs from Case 1 in that its gasifier and coal handling systems were sized for maximum coal feed rates. The larger feed rates would provide enough syngas production to fully load the combustion turbine regardless of the type of coal used.
TBD = To be determined; tpy = tons per year; mtpy = metric tons per year; psig = pounds per square inch gauge measurement; kPa = kilopascal; b/h = pounds; per hour; kg/h = kilograms per hour.
Source: FG Alliance, 2007***b***.

An important part of the FutureGen Project is to incorporate the latest technologies ready for full-scale or sub-scale testing or commercial deployment. To identify technology options, the Alliance started with a list of major components and subsystems of the power plant facility and created a matrix of potential equipment configurations. After presentations by various technology vendors and with assistance from numerous power plant experts, the matrix of potential configurations was narrowed to three to support the conceptual design. While the final technology selections have not yet been made, the IGCC processes would be generically similar, regardless of specific technologies.

The three potential technology cases share many components and processes in common, with the primary difference being the type of gasifier technology used. Cases 1, 2, and 3A are stand-alone alternatives that are capable of meeting the design requirements of the project. Case 3B is a smaller, side-stream power train that would enable more research and development activities than the main train of the power plant (Cases 1, 2, and 3A). Case 3B, if implemented, would be paired with Cases 1, 2, and 3A. Case 3A is similar to Case 1, except the gasifier output is greater.

One goal of the FutureGen Project is to demonstrate gasification technology over a range of different coal types. Therefore, the facility would be designed to use bituminous, sub-bituminous, and ***possibly*** lignite coals. For developing the performance boundary, the Alliance assumed technology cases and operation of the plant using three coal types: PRB sub-bituminous, Illinois Basin bituminous, and Northern Appalachia Pittsburgh bituminous.

The FutureGen plant may not be designed optimally for any fuel type to either maximize efficiency in energy conservation or minimize pollutant emissions. Furthermore, because the plant would be designed to accommodate a variety of research and development (R&D) applications that might be proposed in the future, plant components would be integrated loosely such that the power plant as a whole may not perform optimally from an energy conversion perspective.

The Alliance estimated the operating parameters for a bounding combination of the technologies and coal types. Emissions of air pollutants, quantities of coal, and waste generation were calculated ***as*** the maximum possible under Cases 1, 2, and 3A for the three coal types, plus the maximum possible under Case 3B for the three coal types. Quantities of process chemicals were calculated using the maximum possible under Cases 1, 2, and 3A. This resulted in conservative estimates of possible air emissions and impacts related to use of process materials, waste management, and the associated transportation.

The FutureGen Project would have a sophisticated control system to safely manage normal operations as well as planned and unplanned restarts. Unplanned restart events include situations where a specific component or system has a performance problem and actions are required to restore normal operations or shut down the plant. Unplanned restart events may involve such actions as venting syngas to a flare for a short period (hours). Air emissions during startups and unplanned restart events (upset conditions) tend to be very high in pollutants emitted relative to normal, steady-state operations, but occur for short durations (minutes to hours). For purposes of estimating the upper bound of air emissions, the air emissions profile used in this EIS includes an estimated number of unplanned restarts. Therefore, the air emissions profile would be greater than anticipated from steady-state operation of the project. Including all unplanned restarts, the FutureGen Project is still expected to have low air emission levels when compared to traditional coal combustion power plants. As is the case with any new technology, the anticipated number of unplanned restarts usually declines with experience.

The FutureGen Project would also conduct research on additional technologies. After the four-year initial testing and research phase, it is likely that the power plant could still be used for additional research activities and would gradually be operated as a commercial power plant. Additionally, the Alliance could undertake various activities that would help offset the cost of operation. These activities include selling some or all of the CO_2 for EOR or enhanced coalbed methane recovery, removing the Claus Plant and co-sequestering H_2S with the CO_2, and possibly selling a portion of the H_2. Potential impacts associated with these activities are discussed in Section S.***10***.

S.7.2 *CARBON SEQUESTRATION*

S.7.2.1 Overview of CO_2 Capture and Geologic Sequestration

A key component of the FutureGen Project is the geologic sequestration of CO_2 to help achieve near-zero emissions. Geologic sequestration is the injection of CO_2 or other GHGs into subsurface porous and permeable rocks in such a way that they remain permanently stored. The injection of gases underground is not a new concept and has been performed successfully for decades, including natural gas storage projects around the world and acid gas injection at EOR projects.

Geologic Sequestration is the injection of CO_2 or other GHGs into subsurface porous and permeable rocks in such a way that they remain permanently stored.

Deep Saline Formation is an underground rock formation, generally more than 0.45 mile (731 meters) beneath the ground surface, composed of permeable materials and containing highly saline water.

Types of geologic formations capable of storing CO_2 include oil and gas bearing formations, saline formations, basalts, deep coal seams, and oil- or gas-rich shales. Not all geologic formations are suitable for CO_2 storage; some are too shallow and others have low permeability (the ability of rock to transmit fluids through pore spaces) or poor confining characteristics. Formations suitable for CO_2 storage have specific characteristics such as thick accumulations of sediments or rock layers, permeable layers saturated with saline water (saline formations), extensive covers of low permeability sediments or rocks acting as seals (caprock), structural simplicity, and lack of transmissive faults (IPCC, 2005). ***DOE recommends that interested readers on this topic also see the Carbon Sequestration Atlas of the United States and Canada at*** http://www.netl.doe.gov/technologies/***carbon_seq/refshelf/atlas/introduction.pdf.***

Under the FutureGen Project, CO_2 from the power plant would be captured, transported by pipeline, if necessary, and injected into a deep saline formation (see Figure S-19). The deep saline formation would be overlain by several other formations, including one or more low permeability caprock layers. Deep saline formations are the focus of the FutureGen Project because they are believed to have the largest capacity for CO_2 storage and are much more widespread geographically than other geologic sequestration options.

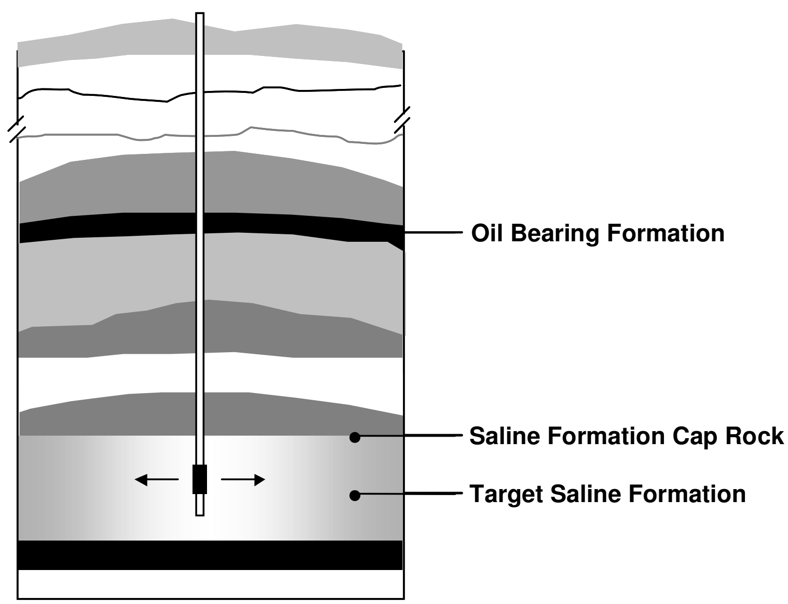


Figure S-19. Geologic Sequestration in a Deep Saline Aquifer

Improving the fundamental understanding of the transportation and geologic sequestration of large quantities of CO_2 is critical to advancing the commercial feasibility of this technology. This understanding is also important to public acceptance of this technology. The FutureGen Project would conduct subsurface research related to geologic storage of CO_2, and would function as a platform for testing and deploying new technologies related to CO_2 storage, monitoring, and, perhaps, leak mitigation. The project would help planners, engineers, and scientists to understand CO_2 sequestration in the context of formation structure, chemistry, and performance.

Monitoring could be the most costly single component of the CO_2 storage effort because of the infrastructure required (e.g., deep monitoring wells). The FutureGen Project would represent a first-of-a-kind environment in which to evaluate combinations of existing and new monitoring techniques and to determine the efficacy and cost of providing quantitative data on the location of the CO_2 plume, seal integrity, and early warning of CO_2 seepage.

Supercritical CO_2 – CO_2 usually behaves as a gas in air or as a solid in dry ice. If the temperature and pressure are both increased (above its supercritical temperature of 88ºF [31.1ºC] and 73 atmospheres [1,073 psi]), it can adopt properties midway between a gas and a liquid, such that it expands to fill its container like a gas but has a density like that of a liquid.

The FutureGen Project would separate and capture CO_2 during the second stage of syngas cleanup. The separated CO_2 would then be transported in its supercritical phase via pipeline to one or more injection wells at the sequestration site. For three of the four alternative sites, injection wells would be miles away from the power plant site, requiring the construction of varying lengths of CO_2 pipeline. The pipeline would be buried at least 3 feet (0.9 meter) below the surface except where it is necessary to come to the surface for valves and metering.

An objective of the FutureGen Project is to inject between 1.1 and 2.8 million tons (1 and 2.5 MMT) per year of CO_2 into a deep saline reservoir, providing permanent storage of the CO_2 underground. Most likely, all captured CO_2 would be stored in deep saline reservoirs; however, the goal is to sequester at least 1.1 million tons (1 MMT) of CO_2 per year in deep saline reservoirs. It is possible that CO_2 captured in excess of 1.1 million tons (1 MMT) per year could be sold for use in EOR or coalbed methane recovery. Assuming a 1.1 million ton (1 MMT) per year CO_2 injection rate and a 50-year power plant lifespan, the target formation could receive up to 55 million tons (50 MMT) of CO_2. The number of injection wells required to meet the injection goal would vary, depending on the characteristics of the target formation. In addition, the Alliance may install one or more backup injection wells to accommodate periods of time for routine maintenance and inspection of the primary injection well(s). Where necessary, one or more extraction wells would be installed to remove formation water and thereby decrease the risk of over-pressurization caused by the injection of CO_2.

The underground injection of CO_2 would be regulated under EPA's Underground Injection Control (UIC) Program. The UIC Program works with state and local governments to oversee underground injection of wastes in an effort to prevent contamination of drinking water resources. All injection wells require authorization under general rules or specific permits. Many states, including Illinois and Texas, have primary enforcement responsibility (primacy) for the UIC Program. It is likely that the FutureGen Project injection wells would be treated as Class V (experimental) wells under the UIC Program.

Fate and Transport of Injected CO_2

Permeability indicates the rate at which fluids would flow through the subsurface and reflects the degree to which pore space is connected.

To increase the storage potential, CO_2 would be injected into very deep formations where it could maintain its dense supercritical state. The fate and transport of CO_2 in the formation would be influenced by the injection pressure, dissolution in the formation water, and upward migration due to CO_2's buoyancy.

To provide secure storage (e.g., structural trapping), a low permeability rock layer (caprock) would act as a barrier and cause the buoyant CO_2 to spread laterally. As CO_2 migrates through the formation, it would slowly dissolve in the formation water. In systems with slowly flowing water, reservoir-scale numerical simulations show that, over tens of years, up to 30 percent of the injected CO_2 would dissolve in formation water. Larger basin-scale simulations suggest that, over centuries, the entire CO_2 plume would dissolve in formation water. Once CO_2 is dissolved in the formation water, it would no longer exist as a separate phase (thereby eliminating the buoyant forces that drive it upwards), and it would be expected to migrate along with the regional groundwater flow.

The dissolved CO_2 would make the formation water more acidic, with formation water pH dropping as low as 3.5, which would be expected to dissolve some mineral grains and mineral cements in the rock, accompanied by a rise in the pH of the formation water. At that point, some fraction of the CO_2 may be converted to stable carbonate minerals (mineral trapping), the most permanent form of geologic storage. Mineral trapping is believed to be comparatively slow, taking hundreds or thousands of years to occur (IPCC, 2005).

Potential Leakage Pathways

A leading concern regarding geologic sequestration is the potential leakage of sequestered CO_2 from underground formations into the atmosphere or into an ***underground source of drinking water.*** The mechanisms for leakage are highly dependent on the storage formation's geologic conditions. Pathways and mechanisms for leakage can include:

- Failure of seals near the borehole (due to corrosion of the formation rock, the casing, or the cement between the casing and the formation);
- Leakage through abandoned boreholes and wells;
- Migration of CO_2 through the caprock formation due to its innate permeability;
- Failure of the caprock by formation stress and fluid pressure changes from injection; and
- Failure of the caprock by external forces such as tectonic movement, stress caused by subsidence, or earthquakes.

Overall, the main risks of leakage of geologically sequestered CO_2 are due to well borehole leakage and caprock failure. Under the Proposed Action***, perhaps in connection with the Area of Review requirements for a UIC permit (as indicated by the State or Federal UIC director)***, the Alliance would identify, plug and abandon (according to state regulations) existing unused wells and boreholes that penetrate the primary seals of the injection reservoir. The Alliance conducted a search for such wells at each of the sites, and their presence relative to the storage formation was addressed in the Risk Assessment (TetraTech, 2007) that was prepared in support of this EIS. Risks associated with other leakage pathways, such as migration through caprock and failures caused by external forces are expected to be small because the alternative sites have met the geologic and seismic criteria developed for the FutureGen Project.

Reservoir Modeling of Injected CO_2

Predictions of the distribution of CO_2 injected into the saline formations at the alternative sites were made using numerical simulation. The simulation used a model called Subsurface Transport Over Multiple Phases (STOMP), which is a general-purpose tool for simulating subsurface flow and transport, and addresses a variety of subsurface environments and flow mechanisms (PNNL, 2006).

> **STOMP** model documentation and information can be found at:
> - http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/p36.pdf
> - http://www.princeton.edu/~cmi/events/Workshop%20Summary%202005.pdf

Two scenarios were considered as representing reasonable bounds on the expected CO_2 output and sequestration operations for the FutureGen Project. Although CO_2 output depends on many factors, such as the coal type being gasified, the probable upper bound would be 7,551 tons (6,850 metric tons) per day, which results in an annual injection rate of 2.8 million tons (2.5 MMT) per year (assuming 100 percent operation over an entire year). Therefore, the first scenario modeled assumed this maximum injection case. A second case analyzed a constant injection rate of 1.1 million tons (1 MMT) per year, corresponding to the minimum rate of sequestration to be met over the first four-year operating period.

For both scenarios, a total of 55 million tons (50 MMT) of CO_2 would be injected into the target formation. This maximum quantity is based on the requirement set forth in the RFP for candidate sites.

To achieve an injection target of 55 million tons (50 MMT) of CO_2, an injection period of 20 years was used for the 2.8 million tons (2.5 MMT) per year scenario, and an injection period of 50 years was used for the 1.1 million tons (1 MMT) per year scenario. However, the reservoir model was run for 50 years in both cases. For all of the sites except Jewett, the largest plume radius predicted by the numerical modeling was associated with the injection of 1.1 million tons (1 MMT) for 50 years. As a result of the modeling, it is estimated that the largest plume radius at Jewett would be associated with the injection of 2.8 million tons (2.5 MMT) for 20 years.

DOE assessed impacts to environmental resources based on the plume footprint at each site. For purposes of analysis in this EIS, plume radii were calculated by defining the radius as the radial distance from the injection within which 95 percent of the CO_2 mass would be contained. The 95 percent cutoff was used to ensure that the reported plume radii represented the bulk of the injected CO_2. The model results showed thin layers ("stringer" layers) of CO_2 that advanced ahead of the main plume due to high-permeability zones interpreted from well log data. These "stringers" account for a very small fraction of the injected CO_2; neither the existence nor the extent of such high-permeability zones at each site is known. Hence, use of the 95 percent cutoff prevented these stringers from unrealistically inflating the plume radius calculations in a way that would not be justified by the available reservoir data. Because permeability values for different horizontal directions or at different locations in the area were not available, the reservoir model resulted in a circular plume based on the assumption that permeability values were constant horizontally. However, under real-world conditions, there are various factors that would cause the injected plume of CO_2 to be non-circular in shape (plan view or footprint) or larger or smaller than has been predicted here. If the permeability of the rock differs as a function of direction (e.g., less in an east-west direction than in a north-south direction), the plume would have an elliptical (oval) shape instead of a circular shape. Variations in the permeability of the rock over short distances within the formation may also cause the plume to take an irregular shape. Similarly, if the formation has a network of moderately to poorly connected fractures, the plume could follow these fractures, resulting in irregular flow path.

S.7.2.2 Monitoring, Mitigation and Verification

The Alliance would monitor the sequestration efforts, including conditions in the proposed target formation as well as conditions in overlying strata, soil, groundwater supplies, and air. The comprehensive monitoring program would likely include installation of monitoring wells in strategic locations around the injection site in addition to atmospheric and shallow subsurface monitoring stations. As a cooperative project undertaken with DOE financial support, the Alliance would deliver copies of results to DOE.

MM&V is the capability to measure the amount of CO_2 stored at a specific sequestration site, to monitor the site and mitigate the potential for leaks or other deterioration of storage integrity over time, and to verify that the CO_2 is being stored and is not harmful to the host ecosystem.

MM&V encompasses the process for ensuring the safe and permanent storage of sequestered gases. Injection of CO_2 into the subsurface would be regulated under EPA's UIC program. Monitoring would help to satisfy the protection requirements under the UIC program and would be used for a number of purposes, including but not limited to:

- Tracking the location of the plume of injected CO_2;
- Ensuring that the injection well and any monitoring wells or abandoned wells in the area are not leaking; and

- Verifying the quantity of CO_2 that had been injected.

Methods to track CO_2 leaking to the atmosphere above the ground surface are challenging due to the difficulty in detecting small changes in CO_2 concentration above background concentrations that already exist in the atmosphere. However, water-soluble tracers could be added to injected CO_2 to aid the monitoring process. These tracer chemicals can easily be measured at monitoring wells, are not commonly found in nature, do not rapidly degrade or interact with compounds in the formation, and exhibit low toxicity to biota.

In terms of DOE's research program, the total monitoring timeline ***includes*** 1 year of baseline data collection, ***4*** years of active injection, and 2 years of post-injection monitoring. The monitoring scheme would be tailored to the characteristics of the site. If the CO_2 injection operation continues past the research phase, the Alliance or its successor would continue basic monitoring until sometime after the injection stops in accordance with UIC regulations and applicable permit conditions.

Full descriptions of these techniques and the frequency of monitoring and testing are found in the site Environmental Information Volumes (FG Alliance, 2006c, d, e, f). The Alliance may change the types and frequencies of monitoring activities after the initial research and testing phase of the project. As part of the Full Scope Cooperative Agreement, at the end of the 4-year operating period, the Alliance would be obligated to prepare a plan, which is mutually acceptable to DOE, to address the extent of continued monitoring of the sequestered CO_2. Because the FutureGen Project is a research project, the Alliance may use some new and experimental monitoring methods, in addition to traditional methods, to determine the fate and transport of the injected CO_2.

Although leakage would not be expected, operators of the injection site(s) would need to be prepared to address a leak if one occurs. Active or abandoned wells (including the injection wells themselves) are potential pathways, and identifying options for remediating leakage of CO_2 from these pathways is especially important. Similar to occurrences in oil and gas extraction wells, a blow-out could occur at the injection wellhead. Stopping blow-outs or leaks from injection wells or abandoned wells could be accomplished using standard oil field techniques (one such method is to inject a heavy mud into the well casing). After control of the well is re-established, the well could either be repaired or abandoned. Leaking injection wells could be repaired by replacing the injection tubing and packers. If the annular space behind the casing was leaking, the casing could be perforated to allow injection of cement behind the casing until the leak was stopped. If the well could not be repaired, it would be sealed and abandoned using established methods.

S.7.3 RISK ASSESSMENT OF LEAKAGE OF CAPTURED GASES BEFORE GEOLOGIC SEQUESTRATION

One of the distinguishing aspects of the FutureGen Project is the capture of CO_2 (and other gases) from the gasification process. While there are existing power plants that capture CO_2, a FutureGen Project goal is to demonstrate the integration of CO_2 capture with a state-of-the-art (SOTA) IGCC power plant. The FutureGen Project would also provide a test bed for newer capture technologies such as membranes that can separate H_2 from other gases, including CO_2. Because CO_2 capture technologies do pose some risks not commonly found in power plants, DOE assessed the risks and hazards of alternative capture technologies and pipeline transmission of captured gases. DOE worked with nationally recognized experts in relevant fields (e.g., natural gas transmission engineering, pipeline design, and EOR) to develop and apply its risk assessment methodology.

S.7.4 RISK ASSESSMENT OF LEAKAGE OF SEQUESTERED GASES FROM GEOLOGIC RESERVOIRS

A key objective of the FutureGen Project is to verify the effectiveness, safety, and permanence of CO_2 stored in geologic formations. Because geologic sequestration of CO_2 in deep saline formations is a relatively new endeavor in the U.S. and abroad, it is important to advance the understanding of the pathways and associated risks of potential leaks of CO_2 from geologic formations.

In general, standardized, well-accepted methods of assessing risks and impacts of the sequestered gases (CO_2 and any other captured gases) do not exist. To assess the potential environmental impacts of CO_2 sequestration, DOE developed a protocol and methods to assess the risks of both slow leaks (including contamination of groundwater supplies and surface water supplies by sequestered gases and by displaced native fluids) and catastrophic rapid releases of sequestered gases (e.g., a well blow out). Subsequently, DOE asked nationally recognized experts in relevant fields (e.g., reservoir simulation, EOR, natural gas storage field management, geochemistry, geophysics, and reservoir engineering) to review and provide input on the risk assessment methodology (see Appendix D). While the risk assessment has been performed as part of this EIS, it should be noted that, after selection of the host site, the Alliance would undertake a more comprehensive evaluation of the sequestration site and target reservoirs. At that point, the Alliance would drill one or more exploratory wells and conduct more characterization of the risks and potential impacts. DOE then would evaluate the resulting information as part of its preparation of a Supplement Analysis to determine whether a Supplemental EIS would be required. The risk assessment report is posted on the NETL website (http://www.netl.doe.gov/technologies/coalpower/futuregen) and is available on the ***Final*** EIS distribution CD.

S.7.5 FUTUREGEN PROJECT OPERATING CHARACTERISTICS

S.7.5.1 Project Inputs and Outputs

The resource requirements, discharges, wastes, and products of the FutureGen Project are summarized in Table S-8.

Table S-8. Expected Operating Characteristics of the FutureGen Project

Operating Characteristics	Quantity
Generating Capacity, MWe	275
Operating Life, years	Nominally 20-30, maximum 50
CO_2 Sequestered Annually, tpy (mtpy)	Minimum 1,100,000 tons (1,000,000 metric tons) maximum 2,800,000 tons (2,500,000 metric tons)
Maximum CO_2 Sequestered in the Target Reservoir over the Lifetime of the Power Plant, million tons (MMT)	55 (50)
Total Land Area Required for the Power Plant (includes power plant, coal and storage, processing facilities, research facilities, and rail loop), acres (hectares)	200 (81)
Footprint for Power Plant Buildings, acres (hectares)	60 (24)
Full-Time Jobs	200
Coal Consumption (maximum), tpy (mtpy)	1,900,000 (1,720,000)
Train Shipments of Coal, per week	5
Natural Gas Requirements (needed during startups only for approximately 6 hours each event), million cubic feet per hour (cubic meters per hour)	1.8 (50,970)

Table S-8. Expected Operating Characteristics of the FutureGen Project

Operating Characteristics	Quantity	
Process Water Requirements (maximum), gallons per minute (liters per minute)	3,000 (11,356)	
Process Wastewater Generation	None. A ZLD system would be utilized.	
Potable Water Requirements, gallons per day (liters per day)	6,000 (22,712)	
Sanitary Wastewater Generation, gallons per day (liters per day)	6,000 (22,712)	
Slag or Ash Generation, tpy (mtpy)	96,865 (87,875)[1] Off-site markets for slag will be explored; if markets cannot be found that can utilize slag, some or all may be taken to an off-site landfill.	
Elemental Sulfur Generation, tpy (mtpy)	41,232 (37,405) (Note: Some sulfur may be in the form of sulfuric acid. This quantity is undetermined.)	
Solids from ZLD System, tpy (mtpy)	5,558 (5,042)	
Clarifier Sludge, tpy (mtpy)	1,545 (1,402)	
Mercury Removal Carbon Filters[2]	Carbon filters would be regenerated and recycled.	
Sanitary Solid Waste, tpy (mtpy)	335 (305)	
Flare and HRSG Stack Heights, feet (meters)	250 (76)	
Hydrogen Production (for electricity generation), pounds per hour (kilograms per hour)	835 (379)	
Chemicals Consumed, tpy (mtpy)		
Sulfuric Acid	8,790 (7,975)	
Antiscalant	27 (24)	
Sodium Bisulfite	12 (10.9)	
Aqueous Ammonia	1,333 (1,209)	
Sodium Hypochlorite	1,684 (1,528)	
Lime	1,237 (1,122)	
Polymer	295 (268)	
Annual Air Emissions, tpy (mtpy)	First Year (2012) (maximum case)[3]	Targets[4, 5] (2016)
SO_2	543 (493)	212 (192)
NO_2	758 (688)	326 (296)
PM_{10}	111 (101)	33 (30)
Hg	0.011 (0.01)	0.004 (0.0036)
CO	611 (554)	n/a [6]
VOCs	30 (27)	n/a[6]
CO_2	0.18×10^6 (0.17×10^6) up to 0.45×10^6 (0.4×10^6)	0.12×10^6 (0.11×10^6) up to 0.28×10^6 (0.25×10^6)

[1] This value is based on Cases 1, 2, and 3A only. If Case 3B were added, the quantity could potentially be up to 49 percent higher.
[2] Amount of Hg removed during regeneration is undetermined and would be based on the type of coal used.
[3] Values represent the maximum case, based on 85 percent availability (i.e., the power plant running 85 percent of the time) and including the largest number of predicted restarts (predicted number for the first year). Over time, the frequency of restarts and startups would decline, thereby reducing air emission levels. Based on the air emission goals for FutureGen, the project would ultimately achieve considerably lower emissions than a conventional coal-fueled power plant.
[4] These targets correspond to the FutureGen Project Performance Targets presented in Table S-9 based on expected British thermal unit (Btu) output of the power plant.
[5] Planned performance target emissions by year 2016.
MWe = megawatts electrical; tpy = tons per year; mtpy = metric tons per year.
[6] n/a indicates that emissions targets for these pollutants have not been established.

S.7.5.2 Air Emissions

IGCC power plants that are currently in operation have achieved the lowest levels of criteria air pollutant emissions of any coal-fueled power plant technologies (DOE, 2002). However, despite the comparatively low air emissions, the FutureGen Project's emissions of criteria pollutants are projected to exceed the 100 tpy (90.7 mtpy) criteria pollutant threshold for a major source, as defined by Clean Air Act regulations (see Table S-8). Table S-9 presents FutureGen Project performance targets for air emissions compared with DOE's Fossil Energy's Clean Coal Power Initiative (CCPI) targets.

Table S-9. FutureGen Project Performance Targets

Pollutant	FutureGen Performance Targets (by 2016)[1]	DOE's Fossil Energy CCPI Targets (by 2020)
SO_x	>99 percent sulfur removal[2] (0.032 lb [0.015 kg]/10^6 Btu)[3, 4]	>99 percent sulfur removal
NO_X	<0.05 lb [0.02 kg]/10^6 Btu	<0.01 lb (0.005 kg)/10^6 Btu
PM_{10}	<0.005 lb [0.002 kg]/10^6 Btu	<0.002 lb (0.001 kg)/10^6 Btu
Hg	> 90 percent Hg removal (≤0.611 lb [0.277 kg]/10^{12} Btu)[4]	95 percent Hg removal
CO	n/a[5,6]	n/a[6]
VOCs	n/a[6]	n/a[6]
Lead (Pb)	n/a[5, 6]	n/a[6]
CO_2	>90 percent capture and sequestration	n/a[6]

[1] FutureGen facility operating at full load under steady-state conditions. ***Performance targets based on project goals identified in 2004 Report to Congress (DOE, 2004).***
[2] Sulfur removal from feed coal.
[3] Based on the FutureGen Project performance target and calculated with AP-42 (Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources) emissions factors.
[4] Mass emission rates are based on conceptual design coal properties and performance estimates (see Table S-8 for tons per year estimates).
[5] No FutureGen Project Performance Target for Pb and CO; however, existing IGCC power plants have demonstrated CO emission levels of <0.033 lb (0.015 kg)/10^6 Btu and Pb emissions ranging from trace amounts to 2.9 lb (1.3 kg)/10^{12} Btu. Trace amounts means the pollutant is present in levels no greater than 1,000 ppm or <0.1 percent by weight.
[6] n/a = No performance target or no CCPI target.
kg = kilogram; Btu = British thermal unit.
Sources: DOE, 2002; DOE, 2006a; DOE, 2006b.

When switching between coals, performing certain tests, or experiencing a malfunction, the facility would need to be brought down to a reduced state of operations or perhaps be shut down completely. Upon restart, facility air emissions would be higher than steady-state operations as process units are brought online and ramped up to optimum performance. In addition, due to the complexity of integrating advanced technologies, unexpected shutdowns/outages (i.e., resulting in unplanned restarts) are likely to occur. Associated with such unplanned restarts are short-term increases to facility emissions due to the need to flare process gases for a short period, as well as to restart the facility. The types of unplanned restarts and the frequencies of their occurrence are uncertain. Therefore, the Alliance in consultation with DOE developed estimates for unplanned restarts over the life of the project based on experience at existing IGCC facilities. DOE expects that, over time, learning and experience would reduce the frequency and types of unplanned restarts, as reflected in estimates, shown in Table S-9, used for the later years of operation. DOE and the Alliance estimate that the first year of the research and development period would have the greatest number of unplanned restarts with 29 occurrences. Years 2, 3, and 4 are estimated to have 18, 14, and 13 unplanned restart occurrences, respectively.

S.7.5.3 Toxic and Hazardous Materials

The FutureGen Project would use a variety of process chemicals, primarily for the treatment of process water and maintenance of the cooling towers. The selective catalytic reduction (SCR) process would use approximately 1,333 tpy (1,209 mtpy) of aqueous ammonia. If the plant generates sulfur wastes in the form of sulfuric acid instead of elemental sulfur, it is possible that some of the sulfuric acid could be recycled for use in water processing at the plant, although some pre-treatment may be required. Table S-10 lists the estimated quantities and uses of chemicals required to operate the proposed power plant.

Table S-10. Estimated Quantities and Uses of Chemicals for FutureGen Plant Operation

Process	Chemical Type	Estimated Annual Quantity[1] (tpy[mtpy]	Estimated Storage On Site (gallons [liters])
H_2S and CO_2 Separation (1st and 2nd Stage)	Physical Solvent	11,300 gallons (42,775 liters)	940 (3,558)
SCR for NOx removal	Aqueous Ammonia	1,333 (1,209)	28,700 (108,641)
Cooling Tower Operation and Maintenance	Sulfuric Acid	8,685 (7,879)	94,200 (356,585)
	Antiscalant	0.47 (0.43)	8 (30.3)
	Sodium Hypochlorite	1,684 (1,527)	32,900 (124,540)
Water Make-Up Demineralizer	Sodium Bisulfite	7 (6.4)	88 (333)
	Sulfuric Acid	21 (19.1)	225 (851)
	Liquid Antiscalant and Stabilizer	17 (15.4)	281 (1,064)
Wastewater Treatment Demineralization	Sodium Bisulfite	5.0 (4.5)	67 (253)
	Sulfuric Acid	85 (77.1)	921 (3,486)
	Liquid Antiscalant and Stabilizer	10 (8.7)	163 (617.0)
Clarifier Water Treatment Chemicals	Lime	1,237 (1,122)	7,380 (27,936)
	Polymer	295 (268)	5,020 (19,002)

[1] Expressed in tpy (mtpy) unless otherwise indicated.
tpy = tons per year; mtpy = metric tons per year.

S.7.5.4 Pollution Prevention, Recycling, and Reuse

The FutureGen Project would be designed to minimize process-related discharges to the environment. A plan for pollution prevention and recycling would be developed during the site-specific design and permitting steps, and would be put into practice as the power plant becomes operational. Table S-11 lists some measures that may be employed as part of that plan.

Table S-11. Possible Pollution Prevention, Recycling, and Reuse Features

Spill Control Plan	The Spill Control Plan would specify measures to take in the event of a spill, thereby eliminating or minimizing the impact of accidental releases. All aboveground chemical storage tank containment areas would be lined or paved, curbed/diked, and have sufficient volume to meet regulatory requirements. A site drainage plan would also be developed to prevent routine, process-related operations from affecting the surrounding environment.
Feed Material Handling	The coal storage area may be outdoors or covered. Measures would be taken to reduce releases of coal dust and contamination of stormwater runoff.
Coal Grinding and Slurry Preparation	The coal grinding equipment would be enclosed and any vents would be routed to the tank vent auxiliary boiler. The water used to prepare the coal slurry would be stripped process condensate (recycled).
Gasification, High Temperature Heat Recovery, Dry Char Removal and Slag Grinding	The char produced in gasification would be removed and returned to the first stage of the gasifier (recycled). This improves the carbon conversion in the gasifier and reduces the amount of carbon contained in the gasifier slag.
Slag Handling	The slag dewatering system would generate some flash gas that contains H_2S. The flash gas would be recycled back to the gasifier via the syngas recycle compressor. Water that is entrained with the slag would be collected and sent to the sour water stripper for recycle.
Sour Water System	Sour water would be collected from slag dewatering and the low temperature heat recovery system, and the ammonia (NH_3) and H_2S would be stripped out and sent to the SRU. The stripped condensate would be used to prepare coal slurry. Surplus stripped condensate would be sent to the ZLD unit.
ZLD Unit	The ZLD unit would concentrate and evaporate the process condensate. The ZLD unit would produce high purity water for reuse and a solid filter cake for disposal off site. The ZLD would concentrate and dispose of heavy metals and other constituents in the process condensate. The ZLD would also be a recycle unit because the recovered water could be reused, reducing the total plant water consumption.
Hg Removal Features	The Hg removal unit would use specially formulated activated carbon to capture trace quantities of Hg in the syngas. Hg in the sour water handling system would be captured via activated carbon filters placed upstream of potential release points.
AGR	The AGR system would remove H_2S and CO_2 from the raw syngas and produce an H_2-rich synthetic fuel (synfuel) for use in the combined cycle power system. The AGR would produce concentrated H_2S feed for the SRU and concentrated CO_2 for drying, compression, and sequestration. For co-sequestration activities, a mixed stream of H_2S and CO_2 would be compressed and dried for sequestration.
SRU	The SRU would convert the H_2S to elemental sulfur that would be marketed for use as a fertilizer additive or for production of sulfuric acid. The tail gas from the SRU would be recycled back to the gasifier.
Boiler Blowdown and Steam Condensate Recovery	Boiler blowdown and steam condensate would be recovered from the combined cycle power system and gasification facilities, and would be reused as cooling tower makeup water.
Training and Leadership	All corporate and plant personnel would be trained on continuous improvement in environmental performance, especially as such training and programs apply to 1) setting, measuring, evaluating and achieving waste reduction goals; and 2) reporting the results of such programs in annual reports made available to the public.

S.7.6 CONSTRUCTION PLANS

The FutureGen Project facilities would be constructed over the course of up to 44 months, including the installation of utility lines and connections, sequestration site wells and equipment, and supporting structures. Before construction, environmentally sensitive areas at the selected site would be identified so that impacts could be minimized. A Stormwater Pollution Prevention Plan (SWPPP) would be developed to identify BMPs for erosion prevention and sediment control during construction.

Initial site preparation activities may include, depending on the site selected, building access roads, clearing brush and trees, leveling and grading the site, connecting to utilities, and dewatering activities. Construction of temporary parking, offices, and material storage areas would involve the use of large earthmoving machines to clear and prepare the site. Trucks would bring fill material for roadways and the power plant site, remove harvested timber, remove debris from the site, and temporarily stockpile materials. Construction crews would spread gravel and road base for the temporary roads, material storage areas, and parking areas.

Construction material would be delivered to the site by truck and rail. An access road to the power plant site would be developed for construction traffic and completion of the rail spur at the start of construction activities would allow some plant equipment to be delivered by rail. An estimated 20 trucks and approximately two trains per week, would deliver material to the site on a daily basis.

Water would be required during construction for various purposes, including personal consumption and sanitation, concrete formulation, preparation of other mixtures needed to construct the facilities, equipment washdown, general cleaning, dust suppression, and fire protection.

Based on other coal-fueled power plant construction projects, it is estimated that an average of 350 construction workers would be employed throughout the project; however, during peak construction the projected number of employees could be as many as 600 to 700 workers on site (DOE, 2007). The Alliance expects that labor would be supplied through the local building trades. It is estimated that construction workers would work a 50-hour work week and that construction activity would not always be restricted to daytime hours.

Construction at the proposed power plant sites, sequestration sites, utility corridors, and transportation corridors would result in localized increases in ambient concentrations of SO_2, NO_X, CO, VOCs, and PM. These emissions would result from the use of construction equipment and vehicles, including trucks, bulldozers, excavators, backhoes, loaders, dump trucks, forklifts, pumps, and generators. In addition, fugitive dust emissions (i.e., PM emissions) would occur from various construction-related activities, including earth moving and grading, material handling and storage, and vehicles traveling over dirt and gravel areas.

Given the size of the proposed sites and the short duration of the construction period, potential impacts would be localized and temporary in nature. Construction impacts would be minimized through the use of BMPs, such as wetting the soil surfaces, covering trucks and stored materials with tarps to reduce windborne dust, and using properly maintained equipment.

Construction of the FutureGen Project would generate certain amounts of wastes. The predominant waste streams during construction would include vegetation, soils, and debris from site clearing; scrap metal; hydrostatic pressure test (hydrotest) water; used oil; surplus materials; pallets and other packaging materials; and empty containers.

Surplus and waste materials would be recycled or reused to the extent practical. If feasible, removed site vegetation would be salvaged for pulp and paper production, or be recycled for mulch. Depending on the selected site, construction water use would be heaviest during the CO_2 pipeline testing phase. Hydrotest water would be reused for subsequent pressure tests if practical. Spent hydrotest water would be tested to determine if it exhibits hazardous characteristics (e.g., traces of pipe oil or grease). If hazardous, the hydrotest water would be sent off site for treatment; if non-hazardous, it would be routed to the detention basin for discharge to local surface waters (in accordance with the National Pollutant Discharge Elimination System [NPDES] permit). Potential scrap and surplus material, and used lubricant oils would be recycled or reused to the maximum extent practical.

The Alliance would ultimately be responsible for the proper handling and disposal of construction wastes. However, construction management, contractors, and their employees would be responsible for minimizing the amount of waste produced by construction activities. They would also be expected to adhere to all project procedures and regulatory requirements for waste minimization and proper handling, storage, and disposal of hazardous and non-hazardous wastes. Each construction contractor would be required to include waste management in their overall project health, safety, and environmental site plans.

S.7.7 OPERATION PLANS

DOE-sponsored activities under the FutureGen Project would include 1 year of startup (scheduled to begin in 2012); 3 years of plant operation, testing and research; followed by 2 years of additional geologic monitoring of the sequestered CO_2. After the DOE-sponsored research activities (see Section 2.2) conclude, the Alliance and DOE would develop a disposition plan that addresses the future management and operation of the power plant. It is generally expected that the plant would continue to operate for at least 20 to 30 years and possibly up to 50 years.

In addition to operations and management personnel, the FutureGen Project would require qualified staffing in the following areas: power production planning; equipment maintenance; procurement; research and development; health, safety, and environmental protection; administrative support; benefits/human relations; and other necessary functions. The Alliance estimates that the plant would employ approximately 200 full-time workers (FG Alliance, 2006g).

Facility design features and management programs would be established to address hazardous materials storage locations, emergency response procedures, employee training requirements, hazard recognition, fire control procedures, hazard communications training, personnel protective equipment training, and reporting requirements. For accidental releases, significance criteria would be determined based on federal, state, and local guidelines, as well as performance standards and thresholds adopted by responsible agencies.

Basic approaches to prevent spills to the environment include comprehensive containment and worker safety programs. The comprehensive containment program would ensure the use of appropriate tanks and containers, as well as proper secondary containment using walls, dikes, berms, curbs, etc. Worker safety programs would ensure that workers are aware of, and trained in, spill containment procedures and related health, safety, and environmental protection policies.

S.7.8 POST-OPERATION ACTIVITIES

S.7.8.1 Post-Injection Monitoring

One goal of the FutureGen Project is to prove the safe and effective storage of CO_2 in a deep saline formation. At a minimum, post-injection monitoring activities would be conducted in accordance with applicable UIC regulations and permit conditions. The UIC program is evolving to specifically address geologic sequestration and its long-term safety. At this time, it is difficult to precisely predict the types and frequency of post-operational monitoring and testing that may be required under the UIC program.

However, it is likely that seismic and atmospheric monitoring surveys would occur periodically after closure of the injection site. Some subset of monitoring equipment and structures installed during the period of injection may be kept in place to assess long-term, post-closure changes in surface deformation, soil gas, or atmospheric fluxes in CO_2 (FG Alliance, 2006g).

Both the Alliance and DOE acknowledge the need for continued monitoring of the sequestered CO_2 during the period of continued plume expansion or migration following cessation of injection. During the co-funded period of the project, the Alliance would apply a variety of monitoring techniques in an effort to identify those that provide the most useful and practical means of determining the movement of CO_2 and storage integrity of the formation.

As part of the Full Scope Cooperative Agreement activities, DOE and the Alliance will develop a plan for continued monitoring of the sequestered CO_2 after completion of the project.

S.7.8.2 Final Closure Phase Provisions

The planned life of the FutureGen Project would be 20 to 30 years. However, if the facility is still economically viable, it could be operated up to 50 years. A closure plan would be developed at the time that the power plant is permanently closed. The removal of the facility from service, or decommissioning, may range from “mothballing” to the removal of all equipment and facilities, depending on conditions at the time. The closure plan would be provided to local and state authorities as required.

Upon completion of CO_2 injection, all surface facilities would be decommissioned, including connections between the power plant and injection wells. All exposed pipes, along with other surface facilities, would be decommissioned and removed during site closure. All wells drilled for injection or monitoring, and that intercept the target formation, would be plugged and abandoned in accordance with state and federal regulations. However, some monitoring wells should remain in place, to monitor the long-term integrity of the caprock and to test for potential leakage into aquifers above the CO_2 reservoir.

S.8 FUTURE ACTIVITIES

S.8.1 FOLLOW-ON DECISIONS AND PLANNING

No sooner than 30 days after EPA publishes an NOA of the Final EIS, DOE will publish a ROD in the *Federal Register* that explains the agency’s decision on whether to fund the FutureGen Project, and if so, which of the alternative sites, if any, would be acceptable to host the FutureGen Project.

S.8.1.1 Design Development and Refinement

The design of the power plant and CO_2 injection process would continue to be refined until commencement of construction. Some of the assumptions made in this EIS may be modified as the design progresses. The site selected for the project would primarily affect the design elements related to supporting utilities and transportation systems. Additional utility interconnection studies of road and rail designs may be conducted.

S.8.1.2 Additional Site Characterization Activities

At the selected site, the Alliance would undertake more detailed site-characterization, which would support site-specific design work. For the power plant site, these activities could include detailed surveys and elevation measurements, soil tests to support foundation design, biological surveys and cultural resource investigations, if warranted, and local traffic studies. For the sequestration site, these activities could include installation of exploratory wells, seismic imaging of the target reservoir, small-scale injection tests, and additional computer simulation and modeling of plume fate and transport.

Additional site-specific information would be needed to better determine the injectivity and storage capacity of the target reservoirs as well as the integrity of the caprock. The Alliance would gather this information by drilling one or more exploratory wells into the target formation and undertaking various tests and sampling. While drilling, core samples would be taken from the target formation, the primary seal and portions of the overlying zones to determine the bulk permeability and other geologic characteristics of the rock. Well testing could include pressure and temperature readings or fluid testing as described in Section 2.5.2.2.

Well drilling activities would include the creation of a temporary or permanent access road (paved or unpaved) to the well site and installing a temporary catch basin to store produced saline water and drill cuttings. Because these wells would be thousands of feet deep, a single well could require 3 to 5 weeks of drilling depending on the well depth, diameter and formation properties.

The Alliance may also conduct seismic surveys (see Section 2.5.2.2) which are generally conducted over a very large area (larger than the predicted plume radius). The Alliance would secure permission prior to conducting these surveys from affected land owners to gain access, run geophone lines and possibly dig shot-holes. While these surveys use either very small amounts of explosives or heavy steel vibrators to produce sound waves that would be reflected by the subsurface rock layers to varying degrees, vibrations are rarely felt at the surface because the energy levels are small.

S.8.1.3 Future NEPA Activities

Based on the results of the additional site characterization and site-specific preliminary design, DOE will complete a Supplement Analysis to determine whether a Supplemental EIS must be prepared. A Supplemental EIS would be required if there were substantial changes to the Proposed Action or significant new circumstances or information relevant to environmental concerns. If DOE completes a Supplement Analysis or Supplemental EIS, DOE would determine whether to revise the ROD.

S.9 ENVIRONMENTAL CONSEQUENCES

This section provides a summary comparison of the potential environmental impacts to physical, natural, cultural, and socioeconomic resources for the four site alternatives for the FutureGen Project. Impacts are provided in comparative form in Table S-12. Discriminating features and major conclusions of the EIS are presented below. ***The BAFO information for the Mattoon and Odessa sites and their potential impacts have been addressed in Sections S.4.2.1, S.4.2.4, S.4.3, 2.4.4, 2.4.5, and Tables S-12 and 3-3; and therefore, are not reflected in the text of this section.***

Generally, no impacts would be expected under the No-Action Alternative because it is unlikely that the FutureGen Project would proceed without the financial support of DOE. However, the No-Action Alternative would potentially delay or hinder the pursuit of many of DOE's goals for advancing coal technology and for providing scientific and technological information and analysis that would support future large-scale carbon sequestration activities. More specifically, the goals of the Presidential Initiative and the specific FutureGen Project objectives would not be realized.

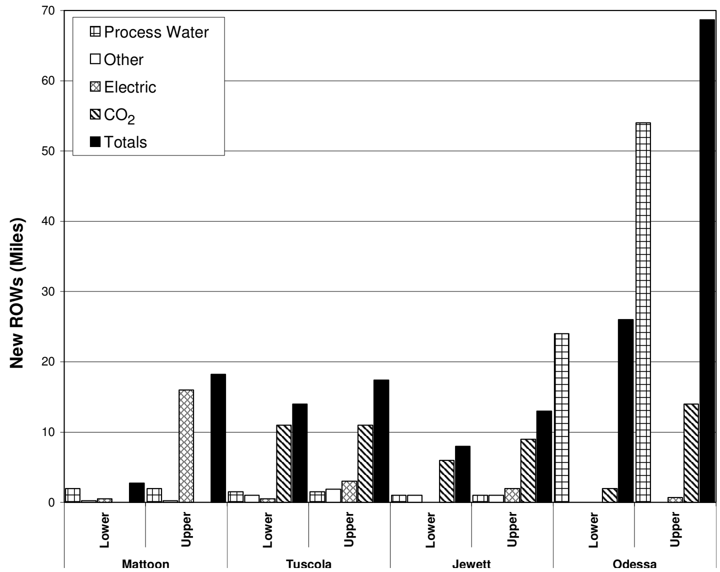
No technical feasibility problems have been identified that would preclude locating the FutureGen Project at any of the alternative sites. Although the FutureGen Power Plant would be very similar regardless of the location that hosts the facility, differences in impacts at the alternative locations relate, in part, to differences in the availability of supporting infrastructure. The major differences among the alternatives from a siting perspective relate to the extent and need for utility corridors (e.g., process water pipeline, potable water pipeline, sanitary wastewater pipeline, electrical transmission line, natural gas pipeline, and CO_2 pipeline) and whether these lines would need new ROWs or can be constructed in existing ROWs.

Figure S-20 illustrates the range of corridor lengths that could be required for each alternative using either new or existing ROWs. ***The BAFO information for the Mattoon and Odessa sites and their potential impacts have been addressed in Sections S.4.2.1, S.4.2.4, S.4.3, 2.4.4, 2.4.5 and Tables S-12 and 3-3, therefore are not reflected in the text of this section.*** Lower and upper bounds are provided because there is uncertainty about which corridor options would be selected. Odessa is likely to require the greatest amount of construction of utility lines, followed by Jewett. Odessa is also likely to require the greatest amount of new ROWs, which could present more impacts associated with route selection. During the construction of utilities, the greatest potential risks for impacts to cultural resources, wetlands, and biological resources are associated with the Jewett and Odessa alternatives, which have the longest lengths of potential utility corridors. However, it is expected that these impacts could be largely avoided as part of the design process, or mitigated through proper construction techniques.

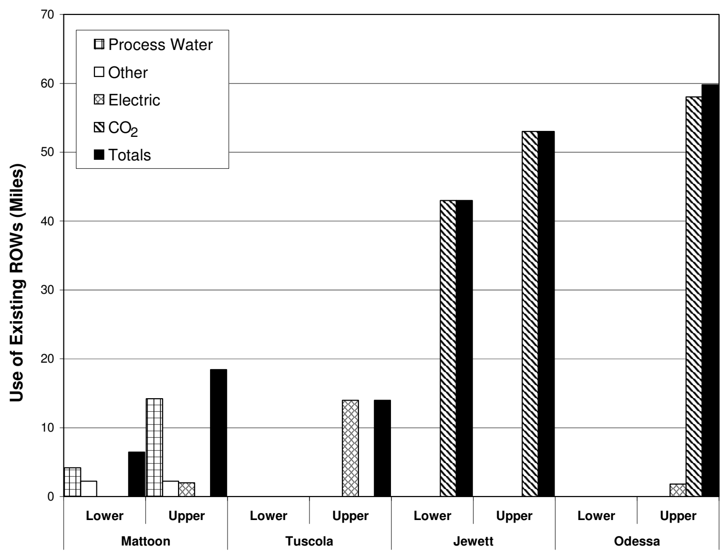
Another important difference in technical feasibility between the alternatives is the approach to supplying process water to the power plant. Mattoon proposes to use treated effluent from local WWTPs; Tuscola proposes to use raw river water pumped into a 150 million-gallon (570 million-liter) holding pond owned by an industrial neighbor; Jewett proposes to use groundwater; and Odessa proposes to use groundwater from one or several sources. Although sufficient water is present for each alternative, the Odessa site has the greatest degree of uncertainty with respect to water supply.

A key concern of the FutureGen Project is the ability to safely capture and sequester CO_2, and potentially H_2S. There are a number of variables that affect the risk associated with these activities including the potential for pipeline ruptures or punctures, injection wellhead leaks, and slow upward leaks through other wells. Major factors that influence the level of risk and potential consequences would be related to the length of pipeline transporting the gas (the longer the pipeline the greater the risk of rupture or puncture), the number of wells that penetrate the primary seals, and the location of these features with respect to human populations. DOE analyzed the potential risks from all of these events, with the potential for a pipeline rupture being considered as unlikely (i.e., one occurrence in 100 to 10,000 years) at three sites to extremely unlikely (i.e., one occurrence per 10,000 to 1 million years) at one site. The potential of a pipeline puncture varied among the four sites from likely ($\geq$1 in 100 years) to extremely unlikely (i.e., one or more occurrences in 10,000 to 1 million years).

The potential for adverse effects from a H_2S release would be associated with pipeline punctures, ruptures, and well leaks. These potential consequences were evaluated for each alternative, with pipeline length and proximity to human populations largely influencing the results. As illustrated in Figure S-21, the greatest potential for adverse effects from an H_2S release would be associated with the Jewett Site, with the potential for adverse effects to occur to approximately 52 individuals followed by the Tuscola Site, with up to approximately 7 individuals potentially affected. The Odessa Site has the lowest potential for adverse effects from inadvertent releases of H_2S. Isolated residences or businesses close to the pipeline could be affected by a release. The estimate of the numbers of individuals experiencing “all effects” shown in Figure S-21 includes effects ranging from mild and transient reactions, such as headaches or sweating, to irreversible adverse effects such as organ failure or death. Given the results of these screening-level risk assessments, the Alliance would undertake design modifications and employ engineering controls to reduce the potential risk and associated consequences at these locations.



Using New ROWs



Using Existing ROWs

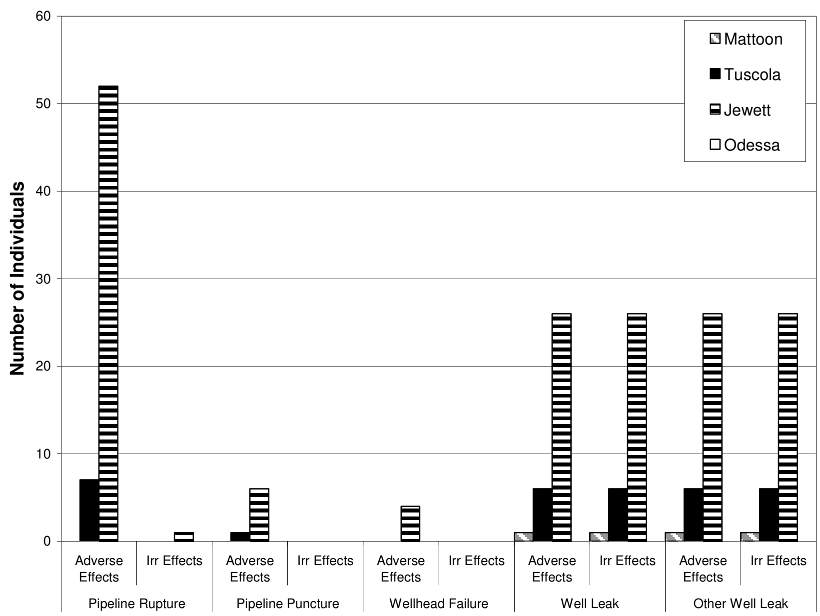
Lower = least amount of ROW potentially required; Upper = most amount of ROW potentially required.

Figure S-20. Comparison of Potential Range of ROWs at Each Alternative Site

For short-term CO_2 and H_2S co-sequestration testing over the two non-consecutive one-week test periods, the concentration of H_2S in the sequestered gas would be 20,000 ppmv (2 percent) or 200 times greater than the base case, which assumed the H_2S concentration would be 100 ppmv. Because these tests would occur for a very short period of time (a total of two weeks), it would be very unlikely that an accidental release would occur during co-sequestration testing. Nevertheless, additional model simulations of pipeline ruptures or punctures to represent releases during the co-sequestration experiment were conducted, as discussed in Section 4.5.5 of the Final Risk Assessment Report. These results show that the distance downwind where the public could be exposed to H_2S at levels that could result in adverse effects are significantly greater than for the base case, and thus more people could be exposed, if a release occurred during an experiment. While the distances where adverse effects occur, as listed in the Risk Assessment, are quite high (tens of miles), they are likely greatly overestimated in the model, as it assumes that the wind would be maintained at the same stability class, wind speed and

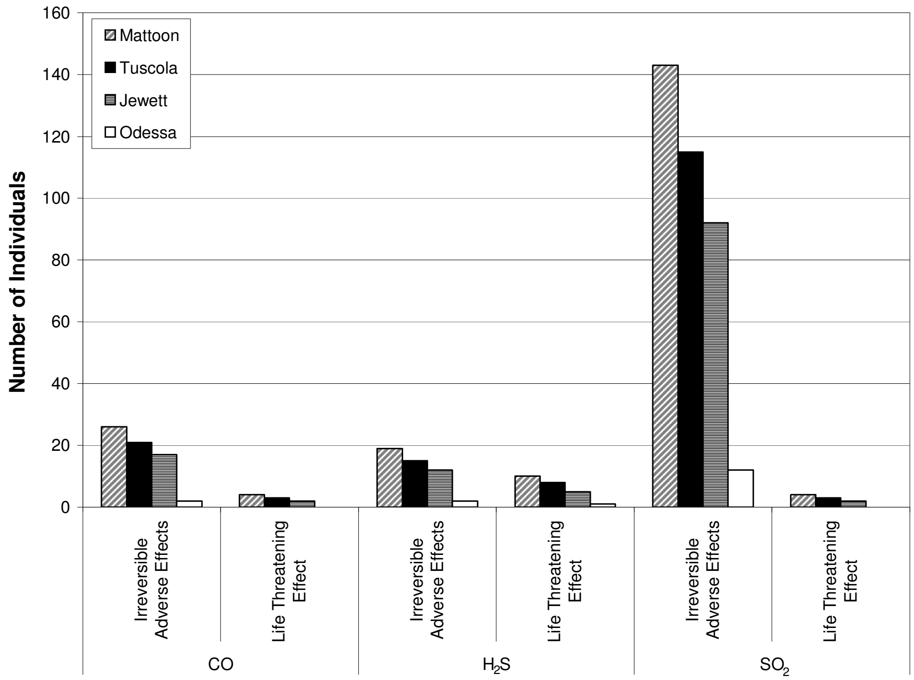
direction over a substantial amount of time (e.g., 19 hours for Jewett). Although short-term testing of co-sequestration (CO_2 with H_2S) may be considered for two weeks during the DOE-sponsored phase of the proposed project, no decision has been made yet to pursue the co-sequestration testing, and further NEPA review may be required before such tests could be conducted. If co-sequestration would be considered for a longer period of time under DOE funding, further NEPA review would be required. After the period of DOE funding, co-sequestration cannot be ruled out as a possible operating scenario. To minimize the potential for releases during the co-sequestration experiments, additional protective measures could be implemented, including inspection of the pipeline before and after the tests and not allowing any excavation along the pipeline route during the tests.

The potential consequence from a catastrophic release from the power plant site is shown in Figure S-22. In the case of a catastrophic Claus unit failure caused by a plant explosion, Mattoon would potentially have the highest irreversible adverse effects from CO, H_2S and SO_2 exposure on individuals (26, 19, and 143, respectively). Tuscola would potentially experience irreversible adverse effects from CO, H_2S and SO_2 exposure to 21, 15, and 115 individuals, respectfully. At Jewett, CO, H_2S and SO_2 releases could cause irreversible adverse effects to 17, 12, and 92 individuals, respectively. Odessa would potentially have the lowest irreversible adverse effects on individuals from exposure to CO, H_2S and SO_2 to 2, 2, and 12 individuals, respectively. Potential life threatening effects from CO exposure due to a Claus Unit failure range from a high of 4 individuals in Mattoon, to zero individuals in Odessa. Potential life threatening effects from H_2S exposure due to a Claus unit failure would range from a high of 10 individuals at Mattoon to 1 individual at Odessa. SO_2 releases due to a Claus unit failure would potentially have life threatening effects ranging from a high of 4 individuals at Mattoon to zero individuals at Odessa. The Riddle Elementary School in Mattoon is located outside of the area where adverse effects would likely occur; however, the Alliance would ensure that the placement of the proposed power plant and appropriate mitigation measures would be implemented to avoid any potential effects.



Under all scenarios Odessa is <1. Adverse effects are health effects ranging from headache or sweating to irreversible (Irr) effects, including death or impaired organ function. Irreversible adverse effects are health effects that include death, permanent impaired organ function, and other effects that impair everyday functions. Pipeline rupture is extremely unlikely (one or more occurrence in greater than one million years) for Mattoon and unlikely (1 or more occurrences in 100 to 10,000 years) for Tuscola, Jewett, and Odessa. Pipeline puncture is extremely unlikely for Mattoon, unlikely for Tuscola and Odessa, and likely (≥1 in 100 years) to unlikely for Jewett. Wellhead failures, well leaks, and other well leaks are extremely unlikely for all four sites.

Figure S-21. Potential Consequence from H_2S Releases



Irreversible adverse effects are health effects that include death, permanent impaired organ function, and other effects that impair everyday functions. Life threatening effects are subset of irreversible adverse effects that may lead to death. Probability of catastrophic release from acts of sabotage or terrorism cannot be predicted.

Figure S-22. Potential Consequence from Catastrophic Accidents/Terrorism or Sabotage

The potential for spills of chemicals associated with the power plant would be the same regardless of the site because the operation of the power plant would be the same at each location. However, the potential effects of a large spill could differ depending on the proximity of residences and facilities to the site. Three scenarios were evaluated to estimate the potential for effects from ammonia releases: a leak from a tank valve, a tanker truck spill, and a tank rupture. Both workers and the general public could be affected by a release due to the two large spills from a tanker truck spill and a tank rupture. The distances where effects could occur differ slightly between the sites due to differences in maximum air temperature. At two of the sites, Mattoon and Tuscola, there are residences within the estimated distances from the proposed power plant site where adverse effects on the general populace could occur. The furthest distance was for a tanker truck spill, since the ammonia spill could be outside of the containment dike. The estimated distances are: Mattoon-14,763 feet (4,500 meters), Tuscola-14,107 feet (4,300 meters), Jewett-15,092 feet (4,600 meters), and Odessa-15,584 feet (4,750 meters). At Mattoon and Tuscola, there are residences within the estimated distances from the proposed power plant site where adverse effects on the general populace could occur. At Jewett, workers at the nearby mine and the existing NRG Limestone Generating Station could possibly be affected. Precautions would be taken to prevent and mitigate the impacts of releases of hazardous materials during construction and routine operations. A potential risk could also occur from a catastrophic accident, terrorism, or sabotage; however, that risk cannot be predicted.

There are also differences in conditions at each of the sites related to the number of wells that penetrate the cap rock sealing the target formation. As evidenced by the outcome of the potential risk of release of sequestered gases for Jewett, this site has the highest number of wells that penetrate the cap rock (between 8 and 57 wells). There are between 2 and 16 wells that penetrate the caprock for the Odessa Sequestration Site; however, because this site is very remote, these wells did not have a large influence on the outcomes of the risk assessment. There are no known wells that penetrate the cap rock for the Illinois sites.

Impacts related to aesthetics, noise, and land use would also vary based on differences in adjacent and surrounding land uses. There are no adjacent residential properties located near the Jewett and Odessa Power Plant Sites and only a few residences within a mile of the Odessa Power Plant Site. There may be residences along the pipeline at both Jewett and Odessa. Only minor, if any, impacts on these resources would be expected for these sites. Both the Mattoon and Tuscola Sites are located in rural areas but have residential properties that are adjacent to the site, specifically two residences for Mattoon and three residences for Tuscola, as well as several dozen residences within a mile of both sites, and perhaps more along the pipeline route. As a result, the visual intrusion (e.g., plant visibility and increased lighting) of the FutureGen Power Plant, as well as noise and traffic impacts associated with the project, would be greater for these locations. The properties located adjacent to the power plant site would experience the greatest impacts with increased noise levels that could be substantial during both plant construction and operation. These properties could also experience reduced property values as a result of these impacts. Therefore, the Alliance would consider project engineering and design features at these sites (e.g., facility layout and aesthetic features, noise dampening devices and enclosures, etc.) to reduce the potential impacts to these properties.

Air emissions from the FutureGen Project would be the same regardless of the site because the operation of the power plant would be the same at each location. The FutureGen Project would not result in increases to air pollutant concentrations that would exceed NAAQS at any of the alternative sites. Differences in potential air quality impacts would be related to the existing ambient air quality conditions at each of the alternative sites, and the primary concern is with respect to PM. Although the FutureGen Project would emit small amounts of air pollutants, ambient air concentrations of $PM_{2.5}$ are approaching the NAAQS for the Mattoon, Tuscola, and Jewett power plant sites, and future development in these areas could degrade regional ambient air quality over time. This situation is most notable for the Jewett Site, where there are numerous planned industrial projects in the region (e.g., new power plants). Significant amounts of air emissions (especially SO_2) from the FutureGen Project are expected to occur during the unplanned restarts, as a result of plant upset when the plant exhaust is being vented to the atmosphere. These unplanned restart emissions would occur for short durations and could result in exceedance of short-term 3-hour SO_2 Prevention of Significant Deterioration (PSD) increments at the Mattoon, Tuscola, and Odessa sites and short-term 3-hour and 24-hour SO_2 PSD increments at the Jewett Site. However, the probabilities of such exceedance are very low. The frequency of plant upset and number of unplanned restart events are expected to reduce over time through learning and experience. Emissions from normal operation of the FutureGen Power Plant would not exceed the PSD increments for any of the criteria pollutants

Table S-12 provides the potential impacts associated within the FutureGen Project in comparative form by site alternative.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
No-Action Alternative			
No impact to environmental resources; no change in existing conditions. Under the No-Action Alternative, DOE would not share in the cost for constructing and operating the FutureGen Project. Without DOE funding, it would be unlikely that the Alliance would soon undertake the commercial-scale integration of CO_2 capture and geologic sequestration with a coal-fueled power plant.			
Proposed Action – Air Quality			
Construction: Air emissions of criteria pollutants from construction equipment and land disturbing activities would result in short-term impacts on local air quality.	**Construction:** Air emissions of criteria pollutants from construction equipment and land disturbing activities would result in short-term impacts on local air quality.	**Construction:** Air emissions of criteria pollutants from construction equipment and land disturbing activities would result in short-term impacts on local air quality.	**Construction:** Air emissions of criteria pollutants from construction equipment and land disturbing activities would result in short-term ***impacts*** on local air quality.
Operations: Air emissions of criteria pollutants from power plant and sequestration operations would increase ambient concentrations in air pollutants. Maximum increases would be:	**Operations:** Air emissions of criteria pollutants from power plant and sequestration operations would increase ambient concentrations in air pollutants. Maximum increases would be:	**Operations:** Air emissions of criteria pollutants from power plant and sequestration operations would increase ambient concentrations in air pollutants. Maximum increases would be:	**Operations:** Air emissions of criteria pollutants from power plant and sequestration operations would increase ambient concentrations in air pollutants. Maximum increases would be:

Pollutant (Odessa: Pollutant[3])	Mattoon FG	Mattoon FG+Ambient	Mattoon NAAQS	Tuscola FG	Tuscola FG+Ambient	Tuscola NAAQS	Jewett FG	Jewett FG+Ambient	Jewett NAAQS	Odessa FG	Odessa FG+Ambient	Odessa NAAQS
Conc. During Normal Plant Operation												
SO_2, 3-hr	0.717	123.75	1,300	0.536	123.57	1,300	0.820	34.85	1,300	0.542	52.89	1,300
SO_2, 24-hr	0.262	70.93	365	0.197	70.87	365	0.415	13.51	365	0.188	13.28	365
SO_2, Annual	0.184	10.65	80	0.048	10.52	80	0.483	3.10	80	0.248	5.49	80
NO_2, Annual	0.256	30.35	100	0.067	30.09	100	0.674	27.01	100	0.346	15.40	100
PM_{10}, 24-hr	0.524	57.86	150	0.393	57.73	150	0.829	55.83	150	0.376	51.71	150
PM_{10}, Annual	0.038	26.04	50	0.010	26.01	50	0.099	26.10	50	0.051	18.05	50
$PM_{2.5}$, 24-hr	0.524	32.46	35	0.393	32.33	35	0.829	30.16	35	0.376	20.71	35
$PM_{2.5}$, Annual	0.038	12.54	15	0.010	12.51	15	0.099	13.80	15	0.051	7.75	15
CO, 1-hr	11.333	5,622.76	40,000	9.470	5,620.90	40,000	10.447	4,018.62	40,000	8.418	7,234.37	40,000
CO, 8-hr	5.005	3,462.94	10,000	4.729	3,462.66	10,000	7.879	1,954.70	10,000	4.855	3,906.86	10,000
Conc. During Plant Upset Events[1]												
SO_2, 3-hr	511.819	634.85	1,300	511.958	634.99	1,300	511.913	545.94	1,300	511.979	564.33	1,300
SO_2, 24-hr	88.000	158.67	365	67.000	137.67	365	89.500	102.59	365	73.000	86.09	365

Mattoon	Tuscola	Jewett	Odessa
Units in micrograms per cubic meter	Units in micrograms per cubic meter	Units in micrograms per cubic meter	Units in micrograms per cubic meter
Probability of exceeding PSD increment: • Normal plant operation: zero percent (all[2]) • Plant upset events: 0.23 percent (3-hr SO_2), zero percent (24-hr SO_2) • Hg Emissions (tpy [mtpy]): 0.011 (0.010) • Total HAP Emissions (tpy [mtpy]): 0.321 (0.291)	Probability of exceeding PSD increment: • Normal plant operation: zero percent (all[2]) • Plant upset events: 0.22 percent (3-hr SO_2), zero percent (24-hr SO_2) • Hg Emissions (tpy [mtpy]): 0.011 (0.010) • Total HAP Emissions (tpy [mtpy]): 0.321 (0.291)	Probability of exceeding PSD increment: • Normal plant operation: zero percent (all[2]) • Plant upset events: 1.66 percent (3-hr SO_2), 0.24 percent (24-hr SO_2) • Hg Emissions (tpy [mtpy]): 0.011 (0.010) • Total HAP Emissions (tpy [mtpy]): 0.321 (0.291)	Probability of exceeding PSD increment: • Normal plant operation: zero percent (all[2]) • Plant upset events: 0.09 percent (3-hr SO_2), zero percent (24-hr SO_2) • Hg Emissions (tpy [mtpy]): 0.011 (0.010) • Total HAP Emissions (tpy [mtpy]): 0.321 (0.291)

[1] Unplanned restart emissions of PM_{10} and $PM_{2.5}$ do not occur during plant upset events. Unplanned restart emissions of NO_2 and CO_2 are lower than steady-state emissions (i.e., <2 percent and <0.2 percent, respectively), therefore impacts are lower.
[2] all = all pollutants and associated averaging period.
[3] ***Best and Final Offer (BAFO) Odessa CO_2 pipeline (Option 2) would require a sulfur removal plant. Potential emissions from additional sulfur removal operations would be minimal because the process occurs in an enclosed system. The additional sulfur removal would be required for the original proposal, as well as for the BAFO Option 2.***
FG = FutureGen; tpy = tons per year; NAAQS = National Ambient Air Quality Standards; PSD = Prevention of Significant Deterioration; HAP = Hazardous Air Pollutant; Hg = mercury.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Climate and Meteorology			
Construction and Operations: No impacts to climate or meteorology. Potential for severe temperature or weather conditions that could temporarily delay construction or affect operations are: Subzero (<0ºFahrenheit [F] [17.8ºCelsius (C)]) days (average): 7.5 Snowfall: 1 snowfall of 6 inches (15.2 centimeters) or more and one ice glaze event per year. ***Tornado intensity F1 or greater within an 850 sq. mi. area: 24 over 50 years*** Severe or extreme drought conditions, potential for wildfire; increased number of water trucks to reduce fugitive dust.	**Construction and Operations:** No impacts to climate or meteorology. Potential for severe temperature or weather conditions that could temporarily delay construction or affect operations are: Subzero (<0ºF [17.8ºC]) days (average): 6 Snowfall: 1 snowfall of 6 inches (15.2 centimeters) or more and one ice glaze event per year. ***Tornado intensity*** F1 or greater ***within an 850 sq. mi. area***: ***10 over*** 50 years Same as Mattoon.	**Construction and Operations:** No impacts to climate or meteorology. Potential for severe temperature or weather conditions that could temporarily delay construction or affect operations are: Subzero (<0ºF [17.8ºC]) days (average): rare Snowfall: Annual snowfall is less than 1.5 inches (3.8 centimeters) and ice glaze events are rare. ***Tornado intensity*** F1 or greater ***within an 850 sq. mi. area***: ***7 over 50*** years Same as Mattoon.	**Construction and Operations:** No impacts to climate or meteorology. Potential for severe temperature or weather conditions that could temporarily delay construction or affect operations are: Subzero (<0ºF [17.8ºC]) days (average): rare Snowfall: Annual snowfall is less than 4.5 inches (11.4 centimeters) and ice glaze events are rare. ***Tornado intensity*** F1 or greater ***within an 850 sq. mi. area***: ***6 over 50*** years Same as Mattoon.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Geology			
Construction: **Target Formation:** Formation: Mt. Simon Injection depth: 1.3 to 1.6 miles (2.1 to 2.6 kilometers) Formation: St. Peter (Optional target reservoir) Injection depth: 0.9 mile (1.4 kilometers) Predicted CO_2 Plume Radius: 1.2 miles (1.9 kilometers) **Caprock:** Formation: Eau Claire Shale Thickness: 500 to 700 feet (152 to 213 meters) Well penetrations (ROI): No known	**Construction:** **Target Formation:** Formation: Mt. Simon Injection depth: 1.3 to 1.5 miles (2.1 to 2.4 kilometers) Formation: St. Peter (Optional target reservoir) Injection depth: 0.9 mile (1.4 kilometers) Predicted CO_2 Plume Radius: 1.1 miles (1.8 kilometers) **Caprock:** Formation: Eau Claire Shale Thickness: 500 to 700 feet (152 to 213 meters) Well penetrations (ROI): No known	**Construction:** **Target Formation:** Formation: Woodbine (Primary) Injection depth: 1 to 1.1 miles (1.6 to 1.8 kilometers) Formation: Travis Peak (Secondary) Injection depth: 1.7 to 2.1 mile (2.7 to 3.4 kilometers) Predicted CO_2 Plume Radius: 1.7 miles (2.7 kilometers) **Caprock (Primary):** Formation: Eagle Ford Shale Thickness: 400 feet (122 meters) Well penetrations (ROI): 8 known, up to 57	**Construction:** **Target Formation:** Formation: Delaware Mountain Group ***(primary)*** and ***Lower*** Queen Formation ***(secondary)*** Injection depth: 0.4 to 1 mile (0.6 to 1.6 kilometers) Predicted CO_2 Plume Radius: 1 mile (1.7 kilometers) **Caprock:** Formation: Queen-Seven Rivers Thickness: 700 feet (213 meters) Well penetrations (ROI): 2 known, up to 16
Operations: **Earthquake potential:** Intensity: Medium (magnitude <5) Likelihood: Possible but not common **Earthquake occurrences since 1974:** Number: 29 Magnitude: 2.7 to 5.0 Distance: Within 100 miles (161 kilometers)	**Operations:** **Earthquake potential:** Intensity: Same as Mattoon Likelihood: Same as Mattoon **Earthquake occurrences since 1974:** Number: 30 Magnitude: 2.4 to 5.1 Distance: Within 120 miles (193 kilometers)	**Operations:** **Earthquake potential:** Intensity: Medium (magnitude <4) Likelihood: Possible but not common **Earthquake occurrences since 1974:** Number: 4 Magnitude: 2.3 to 3.4 Distance: Within 100 miles (161 kilometers)	**Operations:** **Earthquake potential:** Intensity: Medium (magnitude <6) Likelihood: Possible but not common **Earthquake occurrences since 1974:** Number: 40 Magnitude: 2.3 to 5.7 Distance: Within 120 miles (193 kilometers)

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Geology (continued)			
Faults: Although no detailed mapping of faults, recent 2D seismic lines indicate no major faulting at the injection site. Possibility exists for faults associated with nearby anticline; however, these are likely sealing faults. Closest Major Fault: New Madrid 200 miles (322 kilometers) south-southwest. **Potential for Adverse Impacts:** Radon displacement: Low Induced seismicity: Low CO_2 leakage due to seal penetrations or faults: Low	**Faults:** Although no detailed mapping of faults, recent 2D seismic lines indicate no major faulting at the injection site. Strong possibility exists for faults associated with steep flank of nearby anticline; however, these are likely sealing faults. Closest Major Fault: New Madrid 230 miles (370 kilometers) south-southwest. **Potential for Adverse Impacts:** Same as Mattoon.	**Faults:** Multiple surface faults within 10 miles (16 kilometers). Closest Major Fault: Mexia-Talco 30 to 35 miles (48.2 to 56.3 kilometers) sealing fault, New Madrid 400 miles (644 kilometers) north-northeast. **Potential for Adverse Impacts:** Same as Mattoon.	**Faults:** No detailed mapping of faults. Quiescent basement fault beneath ROI. Closest Major Fault: Rio Grande Rift system 210 miles (338 kilometers); New Madrid greater than 800 miles (1,287 kilometers). **Potential for Adverse Impacts:** Same as Mattoon.

ROI = Region of influence.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Physiography and Soils			
Construction: Soil disturbance (including loss, change of composition and potential of spill contamination).	**Construction:** Soil disturbance (including loss, change of composition and potential of spill contamination).	**Construction:** Soil disturbance (including loss, change of composition and potential of spill contamination).	**Construction:** Soil disturbance (including loss, change of composition and potential of spill contamination).
Power Plant Site: Up to 200 acres (81 hectares) permanently lost.	**Power Plant Site:** Same as Mattoon.	**Power Plant Site:** Same as Mattoon.	**Power Plant Site:** Same as Mattoon.
Sequestration Site: Power Plant and Sequestration Site on same parcel of land.	**Sequestration Site**: Up to 10 acres (4 hectares) permanently lost.	**Sequestration Site**: Same as Tuscola.	**Sequestration Site**: Same as Tuscola.
Utility Corridors: Up to 25.6 acres (10.4 hectares) temporarily disturbed.[1]	**Utility Corridors:** Up to 32.4 acres (13.1 hectares) temporarily disturbed.	**Utility Corridors:** Up to 358 acres (145 hectares) temporarily disturbed.	**Utility Corridors:** Up to 341 acres (138 hectares) temporarily disturbed. ***Up to 744 acres (301 hectares).***[1]
Transportation Corridors: Up to 15.9 acres (6.4 hectares) disturbed through construction of infrastructure within the power plant site.	**Transportation Corridors**: Up to 6.7 acres (2.7 hectares) disturbed through construction of infrastructure within the power plant site.	**Transportation Corridors:** ***Existing railroad and road corridors are in place, therefore there would be no soil disturbance through construction of the infrastructure within the power plant site.***	**Transportation Corridors**: Up to 1.8 acres (0.7 hectare) disturbed through construction of infrastructure within the power plant site. ***Sulfur removal plant may require additional transportation corridors.***[2]
Operations: Low potential for contamination due to minor spills at the power plant site and along utility corridors.	**Operations:** Same as Mattoon.	**Operations:** Same as Mattoon.	**Operations:** Same as Mattoon.

[1] If the BAFO options are selected then up to 744 acres (301 hectares) would be impacted; BAFO Odessa process water pipeline corridor would have soil disturbance up to 103 acres (41.7 hectares); Odessa Option 1 CO_2 pipeline, 545 acres (221 hectares); and up to 96 acres (38.8 hectares) for CO_2 pipeline spurs.
[2] BAFO Odessa CO_2 pipeline (Option 2) may require transportation corridors for the sulfur removal plant at the FutureGen Power Plant site or another site (currently unknown).

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Groundwater			
Construction: No groundwater use, impacts are not anticipated.	**Construction:** No groundwater use, impacts are not anticipated.	**Construction:** No groundwater use, impacts are not anticipated.	**Construction:** No groundwater use, impacts are not anticipated.
Operations: Process water source; treated wastewater, no impacts to local aquifers anticipated.	**Operations:** Process water source; ***industrial reservoir filled with water from Kaskaskia River.*** Short-term impacts from supplemental use of groundwater.	**Operations:** Groundwater impact due to increase in aquifer use for power plant process water. Sustainability of aquifer would be maintained.	**Operations:** Groundwater impact due to increase in aquifer use for power plant process water.
Aquifer: n/a	Aquifer: Mahomet (supplemental only)	Aquifer: Carrizo-Wilcox	Aquifer: Undetermined, multiple options***; CRMWD would supply water, adequate capacity.***[2]
Aquifer capacity: n/a	Aquifer capacity: ***over 400 MGD*** (***>*** ***1.5 b***illion liters per day)[1]	Aquifer capacity: 1.23×10^8 m^3/day	Aquifer capacity: 1.28×10^7 to 7.2×10^7 m^3/day
Potable groundwater use to depth: Approximately 175 feet (53.3 meters)	Potable groundwater use to depth: Approximately 100 feet (31 meters)	Potable groundwater exists to depth: Approximately 1,400 feet (427 meters)	Potable groundwater exists to depth: Approximately 1,500 feet (457 meters)
Usage of capacity: n/a	Usage of capacity: 26 percent (short-term)	Usage of capacity: 4 percent	Usage of capacity: 7 to 39 percent
Depth to CO_2 injection zone: Mt. Simon: 1.3 to 1.6 miles (2.1 to 2.6 kilometers) St Peter (optional): 0.9 mile (1.4 kilometers)	Depth to CO_2 injection zone: Mt Simon: 1.3 to 1.5 miles (2.1 to 2.4 kilometers) St Peter (optional): 0.9 mile (1.4 kilometers)	Depth to CO_2 injection zone: Woodbine: 1.0 mile (1.6 kilometers); Travis Peak: 1.7 miles (2.7 kilometers)	Depth to CO_2 injection zone: 0.4 mile (0.6 kilometer)
Impacts of CO_2 sequestration on ***underground source of drinking water*** considered unlikely. Abandoned wells penetrating primary seal would need to be assessed and closed properly.	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Existing wells through Caprock: 0	Existing wells through Caprock: 0	Existing wells through Caprock: Up to 57	Existing wells through Caprock: Up to 16

[1] Figure represents the sustained yield of the aquifer, not total capacity (ISWS, 2007). Lyondell-Equistar well field currently has a capacity of 16 to 17 MGD (61 to 64 MLD).
[2] BAFO Odessa, CRMWD would supply process water utilizing 3 reservoirs and 4 active well fields. Groundwater would be used during the summer months to meet peak demands. FutureGen consumption equals 1.6 x 10^4 m^3/day (4.3 MGD), which is minimal compared to the aquifer capacities reported in Table S-A and Table 2-A for the municipal well field in Ward County (9.0 x 10^4 m^3/day [24.0 MGD]) and compared to the regional aquifer capacity values presented in the Table.
n/a = not applicable.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Surface Water			
Construction: Low potential for increased sediment loads, stream channel erosion, and non-point source pollution from land disturbance and stream crossings.	**Construction:** Same as Mattoon.	**Construction:** Same as Mattoon.	**Construction:** Same as Mattoon.
Pipeline stream crossings: 5	Pipeline stream crossings: ***4***	Pipeline stream crossings: 30	Pipeline stream crossings: Approximately 3 to 6 ***ephemeral draws plus Pecos River***[1]
Operations: Streams affected: Cassell and Kickapoo creek flows reduced by ***diversion of effluent discharge water*** from Mattoon and possibly Charleston wastewater treatment plants ***to provide process water (3,000 gallons per minute [gpm] [11,356 liters per minute [lpm]). Proposed reservoir would provide flexibility to mitigate downstream flow impacts.***	**Operations:** Streams affected: Kaskaskia River flows reduced by process water withdrawals (3,000 gpm [11,356 lpm]) from Lyondell-Equistar reservoir.	**Operations:** Streams affected: No water withdrawals.	**Operations:** Streams affected: No water withdrawals. ***Up to 4.3 MGD (3,000 gpm).***[2]
Sanitary discharge from plant site: Municipal treatment, no surface water discharges or impacts anticipated.	Sanitary discharge from plant site: On-site system, effluent recycled from process water. Additional option for municipal treatment, no surface water discharges or impacts anticipated.	Sanitary discharge from plant site: On-site system, effluent recycled from process water, no surface water discharges or impacts anticipated.	Sanitary discharge from plant site: On-site system, effluent recycled from process water, no surface water discharges or impacts anticipated.
No CO_2 pipeline stream crossings.	Low potential for impacts from CO_2 pipeline leaks at stream crossings.	Same as Tuscola.	Same as Tuscola.

[1] ***BAFO Odessa CO_2 pipeline (Options 1 and 2) would cross the Pecos River (impaired stream).***
[2] ***BAFO Odessa process water option would withdraw up to 4.3 MGD (3,000 gpm) from surface water: O.H. Ivie Reservoir, E.V. Spence Reservoir, and Lake S.B. Thomas (42.8 MGD available aggregate capacity).***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Wetlands and Floodplains			
Construction: **Power Plant Site:** Site design and layout would avoid impacts to wetlands that are on site as indicated below: Wetlands present: Low quality farm pond 0.05 acre[1] (0.02 hectare) Floodplains present: None	**Construction:** **Power Plant Site:** Site design and layout would avoid impacts to wetlands that are on site as indicated below: Wetlands present: None Floodplains present: None	**Construction:** **Power Plant Site:** Site design and layout would avoid impacts to wetlands that are on site as indicated below: Wetlands present: Low quality up to 2 acres (0.8 hectare) Moderate quality up to 0.1 acre (0.04 hectare) Low quality ponds up to 18 acres (7.3 hectares) Floodplains present: None	**Construction:** **Power Plant Site:** Site design and layout would avoid impacts to wetlands that are on site as indicated below: Wetlands present: None Floodplains present: None
Sequestration Site: The sequestration site is located on the same property as the power plant site. **Floodplains present: None**	**Sequestration Site:** Injection wells would be placed to avoid wetlands and floodplains. Wetlands present: 4 areas ***for a total of*** up to ***5*** acres[1] (2 hectares) Floodplains present: None	**Sequestration Site:** Injection wells would be placed to avoid wetlands and floodplains. Wetlands present: Over 43* **National Wetlands Inventory (NWI) mapping indicates that over 43 forested, scrub-shrub, and emergent wetlands associated with streams and on-channel stock ponds are also located within the region of influence (ROI). Wetland delineation required for verification.* Floodplains present: 25 percent of ROI in 100-year floodplains	**Sequestration Site:** Injection wells would be placed to avoid wetlands and floodplains. Wetlands present: None mapped* **Indicated by NWI mapping. Wetland delineation would be required for verification.* Floodplains present: Currently unmapped* **Natural Resources Conservation Service (NRCS) soils data indicate that there are areas within the sequestration site that range from "none" to "rare" to "frequent."*

[1] ***Wetland acreage (hectares) are based upon field-verified wetland delineations conducted in August 2006.***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Wetlands and Floodplains (continued)			
Utility and Transportation Corridors: Directional drilling and site planning would be used to avoid these features ***and minimize impacts***.	**Utility and Transportation Corridors:** Directional drilling and site planning would be used to avoid these features ***and minimize impacts***.	**Utility and Transportation Corridors:** Directional drilling and site planning would be used to avoid these features ***and minimize impacts***.	**Utility and Transportation Corridors:** Directional drilling and site planning would be used to avoid these features ***and minimize impacts***.
Wetlands: up to 29.2 acres[1] (11.8 hectares)	Wetlands: up to 4.2 acres[1] (1.7 hectares)	Wetlands: Over 90 ***acres**** **NWI mapping indicates that over 90 forested, scrub-shrub, and emergent wetlands associated with streams and on-channel stock ponds are also located within the ROI. Wetland delineation required for verification.*	Wetlands: None mapped* ***Up to 23.9 acres (9.7 hectares)*** *[2] **Indicated by NWI mapping. Wetland delineation would be required for verification.*
Floodplains: In certain segments	Floodplains: In certain segments	Floodplains: Portions of all seven segments of CO_2 pipeline	Floodplains: In certain segments of CO_2 pipeline
Temporary impacts from placement of construction equipment and trenching for underground utilities.	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Operations: No impacts to wetlands or floodplains are anticipated.	**Operations:** Water levels in process water reservoir would fluctuate due to water uptakes. Minimal impact anticipated because pond currently experiences these types of fluctuations and the wetland is low value.	**Operations:** Same as Mattoon.	**Operations:** Same as Mattoon.

[1] Wetland acreage (hectares) are based upon field-verified wetland delineations conducted in August 2006.
[2] BAFO Odessa process water pipeline would potentially impact 1 intermittent Palestine wetland up to 8 acres (3.2 hectares). Odessa CO_2 pipeline (Options 1 and 2) would potentially impact up to 15.9 acres (6.4 hectares) for a total impact of 23.9 acres (9.7 hectares).

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Biological Resources			
Construction: **Power Plant Site:** Up to 200 acres (81 hectares) row crops would be lost.	**Construction:** **Power Plant Site:** Same as Mattoon.	**Construction:** **Power Plant Site:** Up to 200 acres (81 hectares) of mixed oak/grassland would be lost.	**Construction:** **Power Plant Site:** Up to 200 acres (81 hectares) of mesquite lotebush-brush and mesquite-juniper brush would be lost.
1 farm pond could be impacted, resulting in a permanent loss of aquatic habitat.	No aquatic habitat present.	3 intermittent tributary streams; 3 man-made impoundments could be impacted, resulting in permanent loss of aquatic habitat.	No aquatic habitat present.
		Potential T&E species present include the Navasota ladies'-tresses. Surveys may be required.	Potential T&E species present at the sequestration site includes the Texas Horned Lizard. Surveys may be required.
Sequestration Site: Same footprint as power plant site, no additional loss.	**Sequestration Site:** Up to 10 acres (4 hectares) row crops would be lost.	**Sequestration Site:** Up to 10 acres (4 hectares) mixed oak/grassland would be lost.	**Sequestration Site:** Up to 10 acres (4 hectares) mesquite-juniper brush would be lost.
Potential threatened and endangered (T&E) species present include the Indiana Bat. Surveys may be required.	Consultation with Illinois Department of Natural Resources, no threatened or endangered species are expected to occur within the sequestration site.	Potential T&E species present include the interior least tern, Houston toad, Bachman's sparrow, white-fared Ibis and state rare invertebrates. Surveys may be required.	Potential T&E species present include the Texas horned lizard. Surveys may be required.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Biological Resources (continued)			
Utility Corridors: Up to 35.3 miles (56.8 kilometers) total, of which 18.8 miles (30.3 kilometers) within new ROW, primarily agricultural row crops would be lost.	**Utility Corridors:** Up to 31.9 miles (51.3 kilometers) total, of which 16.9 miles (27.2 kilometers) within new ROW, primarily agricultural row crops would be lost.	**Utility Corridors:** Up to 63 miles (101 kilometers) total, of which 13 miles (20.9 kilometers) within new ROW, primarily oak/grassland (high quality deer and turkey hunting ground) would be ***temporarily impacted during pipeline construction.***	**Utility Corridors:** Up to 128.5 miles (207 kilometers) total, of which 68.7 miles (111 kilometers) within new ROW, primarily ***non-arable brush lands would be impacted.***
Aquatic habitat of 5 perennial streams could be temporarily impacted by trenching.	Aquatic habit limited, intermittent streams.	Aquatic habitat of 14 perennial and 39 intermittent streams could be temporarily impacted by trenching.	Intermittent/ephemeral streams only, limited aquatic habitat.
Potential T&E species present include the Indiana Bat, Kirkland's snake, and Eastern sand darter. Surveys may be required.	Potential T&E species present include Kirkland's snake. Surveys may be required.	Potential T&E species present include interior least tern, Houston toad, Bachman's sparrow, white-fared Ibis and state rare invertebrates. Surveys may be required.	Potential T&E species present include the Texas horned lizard. Surveys may be required.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Cultural Resources			
Construction: No known cultural resources at the power plant or sequestration site, no impacts anticipated. Phase I survey may be needed for certain utility corridor segments.	**Construction:** Same as Mattoon. Same as Mattoon.	**Construction:** No known cultural resources at the power plant site, no impacts anticipated. Known cultural sites along CO_2 pipeline corridor segments: A-C; 3 B-C; 15 C-D; 13 D-F; 1 F-H; 3 33 recorded sites within region of influence of sequestration site. Phase I surveys and consultation would be needed for these CO_2 pipeline segments.	**Construction:** Same as Jewett. Phase I survey needed for all water, CO_2 pipeline, and transmission line corridors. Consultation needed for potential cultural resources at the sequestration site. Fossil bearing rock formations are extensive in the region of the sequestration site; however, no impacts to unique or irreplaceable invertebrate paleontological resources anticipated. Vertebrate paleontological resources could be impacted.
Operations: Impacts would only occur during construction.	**Operations:** Same as Mattoon.	**Operations:** Same as Mattoon.	**Operations:** Same as Mattoon.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Land Use			
Construction: **Power Plant Site:** Land conversion, acres affected: Up to 200 acres (81 hectares)	**Construction:** **Power Plant Site:** Land conversion, acres affected: Same as Mattoon.	**Construction:** **Power Plant Site:** Land conversion, acres affected: Same as Mattoon.	**Construction:** **Power Plant Site:** Land conversion, acres affected: Same as Mattoon.
Change of land use: Farmland to industrial.	Change of land use: Same as Mattoon.	Change of land use: Industrial storage and pasture to industrial.	Change of land use: Ranch, oil and gas to industrial.
Oil or gas wells displaced: 0	Oil or gas wells displaced: 0	Oil or gas wells displaced: Up to 3	Oil or gas wells displaced: Up to 2
Prime farmland converted: Up to 200 acres (81 hectares), Land Evaluation and Site Assessment (LESA) points = 255 which exceeds the 225 threshold. Site would be reevaluated for change in land use.	Prime farmland converted: Up to 200 acres (81 hectares), LESA points = 239. Site would be reevaluated for change in land use.	Prime farmland converted: Up to 5 acres (2 hectares)	Prime farmland converted: None
Surrounding land uses: 2 residences (directly adjacent) 2 residences (within 0.25 mile [0.4 kilometer]) 20 residences (within 1 mile [1.6 kilometers])	Surrounding land uses: 3 residences (adjacent) 7 residences (within 0.5 mile [0.8 kilometer]); several dozen (within one mile [1.6 kilometers])	Surrounding land uses: 1 small chapel and cemetery (within 1 mile [1.6 kilometers]) no residences.	Surrounding land uses: 3 habitable residences (within 1 mile [1.6 kilometers]
Airspace and Federal Aviation Administration (FAA) conformance: Stacks would be lighted; FAA notification not required.	Airspace and FAA conformance: Stacks would be lighted; FAA notification required.	Airspace and FAA conformance: Same as Mattoon.	Airspace and FAA conformance: Same as Mattoon.
Conforming with zoning requirements: No conflict.	Conforming with zoning requirements: Same as Mattoon.	Conforming with zoning requirements: Same as Mattoon.	Conforming with zoning requirements: Same as Mattoon.
Current zoning: Enterprise Zone: industrial.	Current zoning: Industrial.	Current zoning: None; surrounded by industrial properties.	Current zoning: None; industrial facilities in the vicinity.
Sequestration Site: Land use acres changed: Same as Power Plant Site.	**Sequestration Site:** Land use acres changed: Up to 10 acres (4 hectares) farmland to industrial.	**Sequestration Site:** Land use acres changed: Up to 10 acres (4 hectares) ranch and state land to industrial.	**Sequestration Site:** Land use acres changed: Up to 10 acres (4 hectares) grazing and oil and gas production to industrial.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Land Use (continued)			
Mineral Rights: Option contract includes mineral rights for 444 acres (180 hectares). May require purchase of additional rights to include 0.25 mile (0.4 kilometer) buffer. **Utility Corridors:** Approximate new ROW 18.8 miles (30.3 kilometers) (approximate): 11 to 27 miles (17.7 to 43.5 kilometers) variable width. ***Approximately new ROW 1 mile (1.6 kilometers).[1]*** Impacts of new ROW: Temporary disruption of existing use, existing uses could continue after construction. Temporary impact to the use of Lincoln Prairie Grass Bike Trail during construction of process water pipeline from City of Charleston. **Operations:** **Power Plant Site:** Site is approximately 444 acres (180 hectares), with 200 acres (81 hectares) permanently converted; remaining 244 acres (99 hectares) could be leased for continued agricultural use.	**Mineral Rights:** Option to 10 acres (4 hectares). Title searches for remainder of site are underway. **Utility Corridors:** Approximate new ROW up to 16.9 miles (27.2 kilometers) variable width. Impacts of new ROW: If the 3-mile (4.8-kilometer) ROW for the transmission line is selected, nine landowners would be temporarily impacted; existing uses could continue after construction. **Operations:** **Power Plant Site:** Site is approximately 345 acres (140 hectares), with 200 acres (81 hectares) permanently converted; remaining 145 acres (59 hectares) could be leased for continued agricultural use.	**Mineral Rights:** 50-year lease option with a waiver for mineral rights for at least three injection sites; however, title searches would need to be conducted. **Utility Corridors:** Approximate new ROWs between 10 miles (16.1 kilometers) and 13 miles (20.9 kilometers) variable width. Impacts of new ROW: Same as Mattoon. **Operations:** **Power Plant Site:** Site is approximately 400 acres (162 hectares), with 200 acres (81 hectares) permanently converted; remaining 200 acres (81 hectares) could continue as pasture.	**Mineral Rights:** University of Texas controls land and historically provide subsurface access through easements. Title searches would need to be conducted. The University has indicated it would grant a 50-year lease. **Utility Corridors:** Approximate new ROW 68.7 miles (111 kilometers) variable width. ***Approximately new ROW 2 miles (25.7 kilometers).[2]*** Impacts of new ROW: Same as Mattoon. **Operations:** **Power Plant Site:** Site is approximately 600 acres (243 hectares), with 200 acres (81 hectares) permanently converted; remaining 400 acres (162 hectares) could continue as ranch land.
Sequestration Site: Same as power plant site.	**Sequestration Site:** 10 acres (4 hectares) permanently converted; remaining land could remain in agricultural use.	**Sequestration Site:** 10 acres (4 hectares) permanently converted; remaining land could remain as ranch land.	**Sequestration Site:** 10 acres (4 hectares) permanently converted; remaining land could continue as ranch land and oil and gas activities.

[1] BAFO Mattoon process waterline would require approximately 1 mile (1.6 kilometers) of new ROW.
[2] BAFO Odessa process waterline would require approximately 1 mile (1.6 kilomters) of new ROW.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Aesthetics			
Power Plant Site: **Construction**: Visual intrusion, traffic and noise to nearby residences.	**Power Plant Site:** **Construction**: Same as Mattoon.	**Power Plant Site:** **Construction**: There are no nearby residences; thus, no visual intrusion, traffic or noise impacts.	**Power Plant Site:** **Construction**: Same as Mattoon.
Operations: Visual intrusion, traffic and noise to nearby residences.	**Operations**: Same as Mattoon.	**Operations**: Same as Mattoon.	**Operations**: Same as Mattoon.
Nearby receptors: 2 residences (adjacent to site) 2 residences (within 0.25 mile [0.4 kilometer) 20 residences (within 1 mile [1.6 kilometers])	Nearby receptors: 3 residences (adjacent to site) 7 residences (within 0.5 mile [0.8 kilometer]) Several dozen residences (within 1 mile [1.6 kilometers])	Nearby receptors: No residences (adjacent to or within 1 mile [1.6 kilometers] of site)	Nearby receptors: No residences (adjacent to site) 4 residences (within 0.5 mile [0.8 kilometer])
Daytime visibility: Downtown Mattoon, motorists, and communities within 7 to 8 miles (11.3 to 13 kilometers).	Daytime visibility: Downtown Tuscola, motorists, and communities within 7 to 8 miles (11.3 to 13 kilometers).	Daytime visibility: 0.5 to 1 miles (0.8 to 1.6 kilometers).	Daytime visibility: Motorists within 7 to 8 miles (11.3 to 13 kilometers).
Visibility from public areas: Lake Mattoon and Paradise Lake.	Visibility from public areas: Ervin Park	Visibility from public areas: None	Visibility from public areas: None
Nighttime visibility: Downtown Mattoon, travelers on roadways, and communities within 7 to 8 miles (11.3 to 12.9 kilometers).	Nighttime visibility: Downtown Tuscola, travelers on roadways, and communities within 7 to 8 miles (11.3 to 12.9 kilometers).	Nighttime visibility: minimal	Nighttime visibility: Travelers on roadways and a few residences within 7 to 8 miles (11.3 to 12.9 kilometers).
Sequestration Site: Nearby receptors: Same as power plant site.	**Sequestration Site:** Nearby receptors: Up to 10 residential properties.	**Sequestration Site:** Nearby receptors: Minimal, travelers on adjacent county roads.	**Sequestration Site:** Nearby receptors: Up to 3 residential properties and travelers along I-10.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Aesthetics (continued)			
Utility Corridors: Temporary receptor impacts (buried utilities): The use of Prairie Grass Bike Trail and 1st and 2nd streets and Lafayette Avenue would be temporarily interrupted during construction of utilities. Permanent receptor impacts (High Voltage Transmission Line [HVTL] utilities): Residential properties within 0.25 mile (0.4 kilometer) would have view of HVTL.	**Utility Corridors:** Temporary receptor impacts (buried utilities): 12 residences within 0.25 mile (0.4 kilometer) of proposed CO_2 pipeline may experience visual impacts during construction layout. Permanent receptor impacts (HVTL utilities): 150 residential properties within 0.25 mile (0.4 kilometer) would have view of HVTL.	**Utility Corridors:** Temporary receptor impacts (buried utilities): Receptors adjacent to up to 45 miles (72.4 kilometers) of CO_2 pipeline. Permanent receptor impacts (HVTL utilities): Minimal receptors along up to 2 miles (3.2 kilometers) of new transmission line would have view of HVTL.	**Utility Corridors:** Temporary receptor impacts (buried utilities): Receptors adjacent to up to 54 miles (86.9 kilometers) of water pipeline and 6 miles (9.7 kilometers) of CO_2 pipeline. Permanent receptor impacts (HVTL utilities): Up to 4 residences and travelers along I-20 for up to 2 miles (3.2 kilometers) of new transmission line would have view of HVTL. ***Potential visual impacts of sulfur removal plant and 2 booster pumps.***[1]

[1] ***BAFO Odessa CO_2 pipeline (Option 2) may result in potential visual impacts from the sulfur removal plant at the FutureGen Power Plant or another location (currently unknown) and 2 booster pumps (located on CO_2 pipeline).***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Transportation and Traffic			
Construction: **Power Plant Site:** SR 121 would temporarily degrade from Level of Service (LOS) C to D, which represents traffic conditions approaching unstable flow; however, this is typically considered acceptable for a temporary condition (44 months). CR 13 (between SR 121 and CH 18) would temporarily degrade from LOS A to C, which represents stable flow. Truck routes may be designated to include I-57, CH 18, and CR 13 to reduce traffic through Mattoon.	**Construction:** **Power Plant Site:** CR 1050N and CR 750E would temporarily (44 months) degrade from LOS A to C, which represents stable traffic flow. Truck routes may be designated to include I-57, US 36, CR 1050N and CR 750E to reduce traffic through Tuscola.	**Construction:** **Power Plant Site**: FM 39 would temporarily degrade from LOS B to D, which represents traffic conditions approaching unstable flow; however, this is typically considered acceptable for a temporary condition. SH 164 would temporarily (44 months) degrade from LOS B to C, which represents stable flow.	**Construction:** **Power Plant Site**: FM 1601 would temporarily degrade from LOS A to D, which represents traffic conditions approaching unstable flow; however, this is typically considered acceptable for a temporary (44 months) condition.
Utility Corridors: Up to 35 one-way trips would be added to existing afternoon peak period; however, because construction of utilities would be spread out along the length of corridors, delays to traffic are expected to be minor and temporary.	**Utility Corridors:** Up to 45 one-way trips would be added to existing afternoon peak period; however, because construction of utilities would be spread out along the length of corridors, delays to traffic are expected to be minor and temporary.	**Utility Corridors**: Up to 60 one-way trips would be added to existing afternoon peak period; however, because construction of utilities would be spread out along the length of corridors, delays to traffic are expected to be minor and temporary.	**Utility Corridors**: Up to 110 one-way trips would be added to existing afternoon peak period, because construction of utilities would be spread out along the length of corridors, delays to traffic are expected to be minor and temporary.
Transportation Corridors: Upgrade of CR 13 and the intersection of CR 13 and SR 121 are planned and would cause localized traffic delays; however, a state-required traffic management plan would limit major disruption of traffic, and delays would be temporary.	**Transportation Corridors:** No roadway or intersection improvements planned; therefore, no impacts to vehicular traffic are expected. Construction of new railroad sidetrack is expected to have minimal and temporary impacts to existing CSX Railroad operations because the CSX ROW in this location contains switching facilities that would allow approaching trains to be switched away from the track to which the sidetrack is being connected.	**Transportation Corridors:** No roadway or intersection improvements planned, and therefore, no impacts to transportation resources are expected. Construction of new railroad sidetrack is expected to have temporary impacts to existing Burlington Northern Santa Fe Railroad operations. Impacts would be minimized by completing connection during hours when this track has lightest expected traffic.	**Transportation Corridors:** One grade-separated crossing would be required to extend FM 1601 under railroad and would result in temporary localized traffic delays (additional traffic numbers for this project component were included in traffic analysis conducted for proposed power plant site). Construction of new railroad sidetrack is expected to have temporary impacts to existing Union Pacific Railroad operations. Impacts would be minimized by completing connection during hours when this track has lightest expected traffic.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Transportation and Traffic (continued)			
			Minor temporary disruptions to traffic on 1 major and 47 minor roads.[1] ***Minor temporary disruptions to traffic on 4 major and 119 minor roads.***[2] ***Sulfur removal plant and 2 booster pumps may require additional transportation corridors.***[3]
Construction/Operations: Changes to traffic signal timings may be required at the CH 18/I-57 ramp intersections to accommodate changes in the turning volumes.	**Construction/Operations:** Changes to traffic signal timings may be required at the US 36/I-57 ramp intersections to accommodate changes in the turning volumes at those intersections.	**Construction/Operations:** Changes to traffic signal timings may be required at the US 79/I-45 ramp intersections to accommodate changes in turning volumes at those intersections.	**Construction/Operations:** Traffic signals may be required at two key intersections on FM 1601 to accommodate changes in the turning volumes.
Operations: CR 13 (between SR 121 and CH 18) would degrade from LOS A to B, which represents reasonably free flow of traffic. Other roadway LOSs would remain the same.	**Operations:** CR 1050N and CR 750E would degrade from LOS A to B, which represents reasonably free flow of traffic. Other roadway LOS would remain the same.	**Operations:** FM 39 and SH 164 would degrade from LOS B to C, which represents stable flow of traffic. Other roadway LOS would remain the same.	**Operations:** CR FM 1601 would degrade from LOS A to B, which represents reasonably free flow of traffic. Other roadway LOS would remain the same.
Rail traffic on Canadian National main line and Peoria spur would increase by 10 and 71 percent, respectively, or less than two additional trains per day.	Rail traffic on CSX rail line would increase by 36 percent or less than two additional trains per day.	Rail traffic on Burlington Northern Santa Fe line would increase up to 14 percent or less than two additional trains per day.	Rail traffic on Union Pacific line would increase up to 11 percent or less than two additional trains per day.
Approximately one additional train per day at two at-grade crossings of Peoria spur would delay traffic 6 to 7 minutes at each crossing. No additional railroad crossing protection would be required.	Approximately one additional train per day at CR 750E at-grade rail crossing would delay traffic 6 to 7 minutes. Actuated gates and warning lights would be required at one existing at-grade crossing (CR 750E at CSX rail line).	No traffic delays associated with increased rail traffic are expected. No at-grade crossings would be impacted.	Same as Jewett.

[1] BAFO Odessa process water pipeline construction would result in minor, temporary disruptions to traffic on 1 major and 47 minor roads.
[2] BAFO Odessa CO_2 pipeline construction would result in minor, temporary disruption to traffic on 4 major and 119 minor roads.
[3] BAFO Odessa CO_2 pipeline (Option 2) may require the construction of a new access road and additional transportation corridors for the sulfur removal plant at the FutureGen Power Plant site or another site (currently unknown) and potential access to 2 booster pumps (located on the CO_2 pipeline).

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Noise and Vibration			
Construction: Noise increase (above background level) at closest receptors to plant site: 2 residences: increase of up to 41 A-weighted sound measurement (dBA) (30 feet [9.1 meters] from boundary) Noise exceeding 3 dBA increase above background noise level (impact threshold) within ***2.4*** miles (3.***9*** kilometers) from the site boundary. Receptors affected: One school; several dozen residences	**Construction:** Noise increase (above background level) at closest receptors to plant site: 3 residences: up to 45.7 dBA (adjacent to boundary) 3 residences: up to 9.2 dBA (within 1 mile (1.6 kilometers) Noise exceeding 3 dBA increase (impact threshold) within 1.***5*** miles (***2.4*** kilometers) from the site boundary. Receptors affected: Numerous residences (much of downtown Tuscola)	**Construction:** Noise increase (above background level) at closest receptors to plant site: Chapel: <***15*** dBA (0.25 mile [0.4 kilometer]) Noise exceeding 3 dBA increase (impact threshold) within 1.9 miles (3.1 kilometers) from the site boundary. Receptors affected: None	**Construction:** Noise increase (above background level) at closest receptors to plant site: ***2*** residence**s**: <***6*** dBA (***0.25*** mile [0.***4*** kilometer]) Noise exceeding 3 dBA increase (impact threshold) within 1.9 miles (3.1 kilometers) from the site boundary. Receptors affected: None ***Temporary elevated noise levels 12 churches, 5 schools***[1]
Construction Traffic: Noise increase above background: CH 13 south of CH 18: <8 dBA CH 18 east of CH 13: <***5*** dBA SR 121 near site: 2 dBA	**Construction Traffic:** Noise increase above background: CR 750E north of US 36: <14.***1*** dBA CR 1050N west of US 45: <7.***2*** dBA US 36 east of CR 750E: <***1*** dBA	**Construction Traffic:** No residence along local access route FM 39; no sensitive receptors impacted.	**Construction Traffic:** Noise increase above background: FM 1601 ***north*** of I-20: <***6*** dBA Near I-20: <3 dBA
Startups/Restarts: Noise increase at closest receptors: 2 residences: up to 21 dBA (30 feet [9 meters]) 3 residences: up to 13 dBA (<1 mile [1.6 kilometers])	**Startups/Restarts:** Noise increase at closest receptors: 3 residences: up to 25 dBA (adjacent to boundary) 4 residences: up to 15 dBA (<1 mile [1.6 kilometers])	**Startups/Restarts:** Noise increase at closest receptors: Chapel: <***17*** dBA (0.***25*** mile [0.***4*** kilometers])	**Startups/Restarts:** Noise increase at closest receptors: ***2*** residence**s**: <***4.1*** dBA (***0.25*** mile [0.***4*** kilometers])
Routine Operations: Noise increase (above background level) at closest receptors to plant site: 2 residences: 6 to 9 dBA (30 feet [9.1 meters] from boundary)	**Routine Operations:** Noise increase (above background level) at closest receptors to plant site: 3 residences: up to 12 dBA (adjacent to boundary)	**Routine Operations:** Noise increase (above background level) at closest receptors to plant site: No residences: <3 dBA Chapel: <***6*** dBA (0.***25*** mile [0.***4*** kilometer])	**Routine Operations:** Noise increase (above background level) at closest receptors to plant site: ***2*** residences: <3 dBA ***Sulfur removal plant and 2 booster pumps***[2]

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Noise and Vibration (continued)			
Routine Operations (continued): Noise exceeding 3 dBA threshold within 1.***5*** miles (***2.4*** kilometers) from the center of the site. Receptors affected: 12 residences *3 dBA is the threshold level for human hearing.*	**Routine Operations (continued):** Noise exceeding 3 dBA threshold within 1 mile (1.***6*** kilometers) from the center of the site. Receptors affected: ***7*** residences *3 dBA is the threshold level for human hearing.*		
On-Site Train Operations: Noise increase at closest receptors to rail loop during unloading: 2 residences: <17 dBA 3 residences: <3 dBA (1 mile [1.6 kilometers]) Potential vibration impact within Federal Transit Administration (FTA) threshold of 200 feet (61.0 meters) from rail loop: 1 residence Potential impact to residences within 1 mile (1.6 kilometers) from rail car shakers could generate noise levels up to 118 dBA.	**On-Site Train Operations:** Noise increase at closest receptors to rail loop during unloading: ***7*** residences: <3 dBA (1 mile [1.6 kilometers]) Potential vibration impact within FTA threshold of 200 feet (61.0 meters) from rail loop: No residences Potential impact to residences within 1 mile (1.6 kilometers) from rail car shakers could generate noise levels up to 118 dBA.	**On-Site Train Operations:** Noise increase at closest receptors to rail loop during unloading: No residences: <3 dBA Chapel: <3 dBA Potential vibration impact within FTA threshold of 200 feet (61.0 meters) from rail loop: No residences Potential impact to residences within 1 mile (1.6 kilometers) from rail car shakers could generate noise levels up to 118 dBA.	**On-Site Train Operations:** Noise increase at closest receptors to rail loop during unloading: ***2*** residences: <3 dBA Potential vibration impact within FTA threshold of 200 feet (61.0 meters) from rail loop: No residences Potential impact to residences within 1 mile (1.6 kilometers) from rail car shakers could generate noise levels up to 118 dBA.
Operations Traffic: Noise increase above background: CH 13 south of CH 18: <4 dBA CH 18 east of CH 13: <2 dBA SR 121 near site: <1 dBA	**Operations Traffic:** Noise increase above background: CR 750E north of US 36: <9.***4*** dBA CR 1050N west of US 45: <***4.1*** dBA US 36 east of CR 750E: <3 dBA	**Operations Traffic:** No residence along local access route FM 39; no sensitive receptors impacted.	**Operations Traffic:** Noise increase above background: FM 1601 ***north*** of I-20: <***3*** dBA near I-20 <***1*** dBA
Train Traffic: The frequency of occurrence of noise at current levels from passing trains would increase by 71 percent on the Peoria spur and 10 percent on the Canadian National main line (less than two additional trains per day).	**Train Traffic:** The frequency of occurrence of noise at current levels from passing trains on the CSX rail line would increase by 24 to 36 percent (less than two additional trains per day).	**Train Traffic:** The frequency of occurrence of noise at current levels from passing trains on the Burlington Northern Santa Fe rail line would increase by 14 percent (less than two additional trains per day).	**Train Traffic:** The frequency of occurrence of noise at current levels from passing trains would increase by 11 percent on the Union Pacific rail line (less than two additional trains per day).

[1] ***BAFO construction of the Odessa process water pipeline would have temporary elevated noise levels to 12 churches and 5 schools, and the population near the pipeline construction zones, especially near the proposed process water supply.***
[2] ***BAFO Odessa sulfur removal plant and 2 booster pumps (located on CO_2 pipeline) could potentially increase noise levels.***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Utility Systems			
Potable Water: Source: Municipal system Sufficient capacity: Yes Pipelines: 1 mile (1.6 kilometers)	**Potable Water**: Source: Municipal system Sufficient capacity: Yes Pipelines: <1 mile (<1.6 kilometers)	**Potable Water:** Source: Same as process water Sufficient capacity: Yes Pipelines: Same as process water	**Potable Water:** Source: Same as process water Sufficient capacity: Yes Pipelines: Same as process water
Process Water: Source: Mattoon and possibly Charleston Wastewater Treatment[1] Plants Sufficient capacity: Yes 7.1 MGD (26.9 MLD) Pipelines: Possibly up to 14.3 miles[2] (23 kilometers)	**Process Water:** Source: Lyondell-Equistar & Kaskaskia River Sufficient capacity: Yes 150 million-gallon (568 million-liter) holding pond Pipelines: 1.5 miles (2.4 kilometers)	**Process Water:** Source: Groundwater Carrizo-Wilcox Sufficient capacity: Yes 3,000 gallons (11,356 liters) per minute Pipelines: <1.0 mile (<1.6 kilometer)	**Process Water:** Source: Groundwater Multiple aquifers***; combination of groundwater and surface water processed through the City of Odessa water treatment plant.***[4] Sufficient capacity: Yes Based on state geologist report Pipelines: 24 to 54 miles (38.6 to 86.9 kilometers)
Sanitary Wastewater: Source: Municipal system Sufficient capacity: Yes Pipelines: 1.25 mile (2 kilometers)	**Sanitary Wastewater:** Source: Municipal system Sufficient capacity: Yes Pipelines: 0.9 mile (1.4 kilometers)	**Sanitary Wastewater:** Source: New on-site system Sufficient capacity: Yes Pipelines: No pipeline required	**Sanitary Wastewater:** Source: New on-site system Sufficient capacity: Yes Pipelines: No pipeline required
Electrical Transmission: Transmission Capacity - Preliminary indication that capacity exists. Further study required: Yes (Midwest Independent System Operator [MISO] Study ongoing) Possibility of curtailment[3]: Yes New or upgraded lines: 0.5 to 16 miles (0.8 to 25.7 kilometers)	**Electrical Transmission:** Transmission Capacity - Preliminary indication that capacity exists. Further study required: Yes (MISO Study ongoing) Possibility of curtailment[3]: Yes New or upgraded lines: 0.5 to 17 miles (0.8 to 27.3 kilometers)	**Electrical Transmission:** Transmission Capacity – Upgrade needed prior to operation. Further study required: No Possibility of curtailment[3]: Yes New or upgraded lines: 0 to 2 miles (0 to 3.2 kilometers)	**Electrical Transmission:** Transmission Capacity – Upgrade needed prior to operation. Further study required: No Possibility of **curtailment**[3]: Yes New or upgraded lines: 0.7 to 1.8 miles (1.1 to 2.9 kilometers) ***Sulfur removal plant and 2 booster pumps***[5]

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Utility Systems (continued)			
Natural Gas: Sufficient capacity: Yes 42 million cubic feet per hour (mcf/hr) (1.3 million cubic meters per hour [mcm/hr])	**Natural Gas:** Sufficient capacity: Yes 42 mcf/hr (1.3 mcm/hr)	**Natural Gas:** Sufficient capacity: Yes 12 mcf/hr (0.3 mcm/hr)	**Natural Gas:** Sufficient capacity: Yes 12 mcf/hr (0.3 mcm/hr)
Pipelines: 0.25 mile (0.4 kilometer)	Pipelines: No pipeline required.	Pipelines: Same as Tuscola.	Pipelines: Same as Tuscola.
CO_2 Pipeline: No off-site pipeline required.	**CO_2 Pipeline:** New ROW: 11 miles (17.7 kilometers)	**CO_2 Pipeline:** New ROW: 6 to 9 miles (10 to 14 kilometers)	**CO_2 Pipeline:** New ROW: 2 to ***16*** miles (3 to **25.7** kilometers)

[1] ***If a*** larger reservoir (200 million gallons [757 million liters]) ***is constructed***, then connection to the Charleston WWTP may not be necessary.
[2] Process water from the effluent of the municipal WWTPs of Mattoon with a 6.2-mile (10.0-kilometer) pipeline and possibly Charleston with 8.1 miles (13.0-kilometers) of pipeline, could result in up to 14.3 miles (23 kilometers) of total pipeline ROW.
[3] Curtailment occurs when the system controller from the Independent System Operator observes a thermal or voltage limit overload for an operating situation or, upon performing a contingency analysis, predicts a thermal or voltage limit overload for a planned project.
[4] ***BAFO Odessa process water would come from the City of Odessa water treatment plant that uses a combination of groundwater and surface water.***
[5] ***BAFO Odessa CO_2 pipelines (Option 2) would require a sulfur removal plant either at the FutureGen Power Plant site or another site (currently unknown). Use of the Comanche Creek pipeline would require 2 booster pumps.***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Materials and Waste Management			
Construction Materials: No new sources required. Local and national suppliers well established with adequate production capacity to meet FutureGen needs: Concrete: 500 yd^3/hr ($382 m^3$/hr) Asphalt: 750 tons/hr[1] (680 metric tons/hr) Aggregate: 900,000 tpy (816,466 mtpy) Construction of process water reservoir would increase fill and spoils handling requirements.	**Construction Materials:** No new sources required. Local and national suppliers well established with adequate production capacity to meet FutureGen needs: Concrete: 330 yd^3/hr ($252 m^3$/hr) Asphalt: 1,900 tons/hr[1] (1,700 metric tons/hr) Aggregate: 4.4 million tpy (4 MMT per year)	**Construction Materials:** No new sources required. Local and national suppliers well established with adequate production capacity to meet FutureGen needs: Concrete: 550 yd^3/hr ($420 m^3$/hr) Asphalt: 8,000 tons/day[1] (7,257 metric tons/day) Aggregate: multiple suppliers, production rates not available	**Construction Materials:** No new sources required. Local and national suppliers well established with adequate production capacity to meet FutureGen needs: Concrete: >230 yd^3/hr (>176 m^3/hr) Asphalt: >2,500 tons/day[1] (2,268 metric tons/day) Aggregate: Same as Jewett.
Construction Waste: Regional landfill availability of up to 116 years – Adequate capacity.	**Construction Waste:** Same as Mattoon.	**Construction Waste:** Regional landfill availability of up to 132 years – Adequate capacity.	**Construction Waste:** Regional landfill availability of up to 177 years – Adequate capacity.
Construction Hazardous Waste: Small amounts of hazardous waste generated. Resource Conservation and Recovery Act (RCRA) permit not required.	**Construction Hazardous Waste:** Same as Mattoon.	**Construction Hazardous Waste:** Same as Mattoon.	**Construction Hazardous Waste:** Same as Mattoon.
5 hazardous waste landfills within approximately 100 to 400 miles (161 to 644 kilometers).	Same as Mattoon.	2 hazardous waste landfills within 300 miles (483 kilometers).	1 hazardous waste landfill within 60 miles (96.6 kilometers).
>14 million yd^3 (>10 million m^3) available disposal capacity at closest hazardous waste landfill site.	Same as Mattoon.	2.7 million yd^3 (2 million m^3) available disposal capacity as closest landfill.	5.0 million yd^3 (3.8 million m^3) available disposal capacity at closest site.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Materials and Waste Management (continued)			
Operations Materials: FutureGen demand represents 3.5 percent of coal consumption by electric utilities within the state.	**Operations Materials:** Same as Mattoon.	**Operations Materials:** FutureGen demand represents 1.9 percent of coal consumption by electric utilities within the state.	**Operations Materials:** Same as Jewett.
Chemicals and materials required for operations are common and readily available; markets exist for sulfur, bottom slag, byproducts, and ash.	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.[2]
Operations Waste: Sanitary landfill availability same as identified for construction.	**Operations Waste:** Same as Mattoon.	**Operations Waste:** Same as Mattoon.	**Operations Waste:** Same as Mattoon.[2]
Operations Hazardous Waste: Hazardous waste landfill availability same as identified for construction.	**Operations Hazardous Waste:** Same as Mattoon.	**Operations Hazardous Waste:** Same as Mattoon.	**Operations Hazardous Waste:** Same as Mattoon.
Potential for Spills and Releases: Some risk due to on-site chemical storage requirements. Precautions would be taken to prevent and mitigate the impacts of releases of hazardous materials and waste during construction and routine operations (see Table S-12, Human Health, Safety, and Accidents for evaluations or potential ammonia spills).	**Potential for Spills and Releases:** Same as Mattoon.	**Potential for Spills and Releases:** Same as Mattoon.	**Potential for Spills and Releases:** Same as Mattoon.

[1] Illinois reported by tons/hr and Texas by tons/day for capacity.
[2] ***BAFO Odessa CO_2 pipeline (Option 2) would require a sulfur removal plant. The additional sulfur byproduct would be sold or disposed of in the same manner as the sulfur from the FutureGen Power Plant.***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Human Health, Safety, and Accidents			
Occupational Risks	**Occupational Risks**	**Occupational Risks**	**Occupational Risks**
Construction: Predicted number of annual accident cases (based on expected workforce for the entire project):	**Construction:** Predicted number of annual accident cases (based on expected workforce for the entire project):	**Construction:** Predicted number of annual accident cases (based on expected workforce for the entire project):	**Construction:** Predicted number of annual accident cases (based on expected workforce for the entire project) ***except for construction risks associated with the longer CO_2 pipelines and the greater number of wells***[1]:
Average workforce (350) Total recordable cases = 20 Lost workday cases = 11 Fatalities = <1 (0.1)	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Peak workforce (700) Total recordable cases = 39 Lost workday cases = 22 Fatalities = <1 (0.2)	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Operations: Predicted number of annual accident cases (based on expected workforce of 200 for all project facilities):	**Operations:** Predicted number of annual accident cases (based on expected workforce of 200 for all project facilities):	**Operations:** Predicted number of annual accident cases (based on expected workforce of 200 for all project facilities):	**Operations:** Predicted number of annual accident cases (based on expected workforce of 200 for all project facilities):
Total recordable cases = 2 Lost workdays cases = 1 Fatalities = <1 (0.002)	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Hazardous Air Emissions	**Hazardous Air Emissions**	**Hazardous Air Emissions**	**Hazardous Air Emissions**
Construction: No appreciable risks from hazardous air emissions to general public.	**Construction:** No appreciable risks from hazardous air emissions to general public.	**Construction:** No appreciable risks from hazardous air emissions to general public.	**Construction:** No appreciable risks from hazardous air emissions to general public.
Plant Operations: Total Cancer Risk (vs. EPA risk criterion of 1×10^{-6}) = 0.084×10^{-6}	**Plant Operations:** Total Cancer Risk (vs. EPA risk criterion of 1×10^{-6}) = 0.022×10^{-6}	**Plant Operations:** Total Cancer Risk (vs. EPA risk criterion of 1×10^{-6}) = 0.222×10^{-6}	**Plant Operations:** Total Cancer Risk (vs. EPA risk criterion of 1×10^{-6}) = 0.114×10^{-6}
Total Hazard Coefficient (vs. EPA risk criterion of 1) = 0.0007	Total Hazard Coefficient (vs. EPA risk criterion of 1) = 0.0002	Total Hazard Coefficient (vs. EPA risk criterion of 1) = 0.0017	Total Hazard Coefficient (vs. EPA risk criterion of 1) = 0.0009

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Human Health, Safety, and Accidents (continued)			
Unintentional Sequestration Releases	**Unintentional Sequestration Releases**	**Unintentional Sequestration Releases**	**Unintentional Sequestration Releases**
Construction: Not applicable prior to operation of sequestration facilities.	**Construction:** Not applicable prior to operation of sequestration facilities.	**Construction:** Not applicable prior to operation of sequestration facilities.	**Construction:** Not applicable prior to operation of sequestration facilities.
Pipeline Operations: Number of individuals potentially impacted by release from pipeline rupture (risk rated as extremely unlikely [1 or more occurrences in 10,000 to 1 million years]):	**Pipeline Operations:** Number of individuals potentially impacted by release from pipeline rupture (risk rated as unlikely [1 or more occurrences in 100 to 10,000 years]):	**Pipeline Operations:** Number of individuals potentially impacted by release from pipeline rupture (risk rated as unlikely [1 or more occurrences in 100 to 10,000 years]):	**Pipeline Operations:** Number of individuals potentially impacted by release from pipeline rupture (risk rated as unlikely [1 or more occurrences in 100 to 10,000 years]):
<u>CO_2</u> Adverse effect[2]: 0 Irreversible[3]: 0 Life threatening[4]: 0	<u>CO_2</u> Same as Mattoon.	<u>CO_2</u> Same as Mattoon.	<u>CO_2</u> Same as Mattoon.
<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 7 Irreversible: ≤1 Life threatening: <1	<u>H_2S</u> Adverse effect: 52 Irreversible: <1 Life threatening: 1	<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0
Number of individuals potentially impacted by release from pipeline puncture (risk rated as extremely unlikely [1 or more occurrences in 10,000 to 1 million years]):	Number of individuals potentially impacted by release from pipeline puncture (risk rated as unlikely [1 or more occurrences in greater than 1 million years]):	Number of individuals potentially impacted by release from pipeline puncture (risk rated as likely (≥1 in 100 years) to unlikely [1 occurrence per 100 to 10,000 years]):	Number of individuals potentially impacted by release from pipeline puncture (risk rated as unlikely [1 or more occurrences in 100 to 10,000 years]):
<u>CO_2</u> Adverse effect: 0 Life threatening: 0	<u>CO_2</u> Adverse effect: 0 Life threatening: 0	<u>CO_2</u> Same as Mattoon.	<u>CO_2</u> Same as Mattoon.
<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 1 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 6 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0 ***BAFO CO_2 pipeline Options 1 and 2: approximately same level of risk and potential impacts.[5]***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Human Health, Safety, and Accidents (continued)			
Sequestration Operations: Number of individuals potentially impacted by unintentional release from wellhead failure (risk rated as extremely unlikely [1 occurrence per 10,000 to 1 million years]):	**Sequestration Operations:** Number of individuals potentially impacted by unintentional release from wellhead failure (risk rated as extremely unlikely):	**Sequestration Operations:** Number of individuals potentially impacted by unintentional release from wellhead failure (risk rated as extremely unlikely):	**Sequestration Operations:** Number of individuals potentially impacted by unintentional release from wellhead failure (risk rated as extremely unlikely):
<u>CO_2</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0	<u>CO_2</u> Same as Mattoon.	<u>CO_2</u> Same as Mattoon.	<u>CO_2</u> Same as Mattoon.
<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: <1 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 4 Irreversible: 0 Life threatening: 0	<u>H_2S</u> Adverse effect: 0 Irreversible: 0 Life threatening: 0
Number of individuals potentially impacted by slow upward leakage of H_2S from injection well (risk rated as extremely unlikely): Adverse effect: 1	Number of individuals potentially impacted by slow upward leakage of H_2S from injection well (risk rated as extremely unlikely): Adverse effect: 6	Number of individuals potentially impacted by slow upward leakage of H_2S from injection well (risk rated as extremely unlikely): Adverse effect: 0.4-26	Number of individuals potentially impacted by slow upward leakage of H_2S from injection well (risk rated as extremely unlikely): Adverse effect: 0.3
Number of individuals potentially impacted by slow upward leakage of H_2S from other existing wells (risk rated as extremely unlikely): Adverse effect: 1	Number of individuals potentially impacted by slow upward leakage of H_2S from other existing wells (risk rated as extremely unlikely): Adverse effect: 6	Number of individuals potentially impacted by slow upward leakage of H_2S from other existing wells (risk rated as extremely unlikely): Adverse effect: 0.4-26	Number of individuals potentially impacted by slow upward leakage of H_2S from other existing wells (risk rated as extremely unlikely): Adverse effect: 0.3

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Human Health, Safety, and Accidents (continued)			
Catastrophic Accidents/Terrorism or Sabotage **Operations:** Number of individuals potentially impacted by catastrophic release at plant site[5] (risk of terrorism/sabotage cannot be predicted): CO Irreversible: 26 Life threatening: 4 SO_2 Irreversible: 19 Life threatening: 10 H_2S Irreversible: 143 Life threatening: 4	**Catastrophic Accidents/Terrorism or Sabotage** **Operations:** Number of individuals potentially impacted by catastrophic release at plant site[5] (risk of terrorism/sabotage cannot be predicted): CO Irreversible: 21 Life threatening: 3 SO_2 Irreversible: 15 Life threatening: 8 H_2S Irreversible: 115 Life threatening: 3	**Catastrophic Accidents/Terrorism or Sabotage** **Operations:** Number of individuals potentially impacted by catastrophic release at plant site[5] (risk of terrorism/sabotage cannot be predicted): CO Irreversible: 17 Life threatening: 2 SO_2 Irreversible: 12 Life threatening: 5 H_2S Irreversible: 92 Life threatening: 2	**Catastrophic Accidents/Terrorism or Sabotage** **Operations:** Number of individuals potentially impacted by catastrophic release at plant site[6] (risk of terrorism/sabotage cannot be predicted): CO Irreversible: 2 Life threatening: 0 SO_2 Irreversible: 2 Life threatening: 1 H_2S Irreversible: 12 Life threatening: 0 ***Sulfur removal plant: minimal additional risk[7]***
Ammonia Spills: Evaluations of potential ammonia spills indicate that both workers and the general public could be affected if a leak from a tank valve, a tanker truck spill, or a tank rupture occurred. Estimated distance for potential adverse effect from a tanker truck release: 14,763 feet (4,500 meters)	**Ammonia Spills:** Same as Mattoon. Estimated distance for potential adverse effect from tanker a truck release: 14,107 feet (4,300 meters)	**Ammonia Spills:** Same as Mattoon. Estimated distance for potential adverse effect from a tanker truck release: 15,092 feet (4,600 meters)	**Ammonia Spills:** Same as Mattoon. Estimated distance for potential adverse effect from a tanker truck release: 15,584 feet (4,750 meters)

[1] ***BAFO Odessa CO_2 pipeline (Option 1) presents 3 times greater risk than Option 2; both options present several times greater risk of construction accidents than the original proposal.***
[2] Adverse effects – Health effects ranging from headache or sweating to irreversible effects, including death or impaired organ function.
[3] Irreversible adverse effects – Health effects to include death, permanent impaired organ function and other effects that impair everyday functions.
[4] Life threatening effects – Subset of irreversible adverse effects that may lead to death.
[5] ***BAFO Odessa CO_2 pipelines (Options 1 and 2) have the same level of risks and potential impacts as the original proposal. There would be a slight risk of an accident or event with 2 pipelines rather than just 1 pipeline in the same ROW.***
[6] Pipeline rupture and puncture impacts are shown in a separate category of Table S-12. None of the sites had predicted irreversible or life threatening effects to the public from CO_2.
[7] ***BAFO Odessa CO_2 pipeline (Option 2) could potentially have a minimal risk of accident, terrorism and sabotage from the addition of a second sulfur removal plant or a larger sulfur removal plant.***

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Community Services			
Construction and Operations: Impacts to community services during the operational phase of the proposed facilities would be minor; less than 1 percent reduction to the capacity for community services. No impact on healthcare. The ratio of hospital beds per thousand residents would remain at approximately 3.***8***. During operations, school enrollment would increase by approximately 0.08 percent, which would result in minimal impacts to capacity of local public school systems.	**Construction and Operations:** Same as Mattoon. No impact on health care. The ratio of hospital beds per thousand residents would remain at approximately 3.***2***. During operations, school enrollment would increase by approximately 0.07 percent, which would result in minimal impacts to capacity of local public school systems.	**Construction and Operations:** Same as Mattoon. No impact on health care. The ratio of hospital beds per thousand residents would remain at approximately 2.6. During operations, school enrollment would increase by approximately 0.22 percent, which would result in minimal impacts to capacity of local public school systems.	**Construction and Operations:** Same as Mattoon. No impact on health care. The ratio of hospital beds per thousand residents would remain at approximately 4.5. During operations, school enrollment would increase by approximately 0.36 percent, which would result in minimal impacts to capacity of local public school systems.

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Socioeconomics			
Construction: A potential influx of construction workers could cause a beneficial, short-term impact to housing market and could increase the hotel occupancy rate to 74 percent.	**Construction:** A potential influx of construction workers could cause a beneficial, short-term impact to housing market and could increase the hotel occupancy rate to 80 percent.	**Construction:** A potential influx of construction workers could cause a beneficial, short-term impact to housing market and could increase the hotel occupancy rate to 65.6 percent.	**Construction:** A potential influx of construction workers could cause a beneficial, short-term impact to housing market and could increase the hotel occupancy rate to 72.6 percent.
Residences within facility viewshed that could experience adverse impact to property values: 2 residences (adjacent to site) 2 residences (within 0.25 mile [0.4 kilometer]) 20 residences (within 1 mile [1.6 kilometers])	Residences within facility viewshed that could experience adverse impact to property values: 3 residences (adjacent to site) 7 residences (within 0.5 mile [0.8 kilometer]) Several dozen residences (beyond 1 mile [1.6 kilometers])	Residences within facility viewshed that could experience adverse impact to property values: None	Residences within facility viewshed that could experience adverse impact to property values: None
Tax abatements for 10 years resulting in loss of property taxes: $10,188 per year	***Tax abatements for 10 years resulting in loss of property taxes: $6,695 per year***	***Tax abatements for 10 years resulting in loss of property taxes: $5,884 per year***	***Tax abatements for 10 years resulting in loss of property taxes: $2,799 per year***
Operations: Permanent workers and facility operations would result in:	**Operations:** Permanent workers and facility operations would result in:	**Operations:** Permanent workers and facility operations would result in:	**Operations:** Permanent workers and facility operations would result in:
Overall percent increase in population: 0.04	Overall percent increase in population: 0.04	Overall percent increase in population: 0.10	Overall percent increase in population: 0.20
Permanent jobs: 200 Induced jobs: 240 Percent increase workers: 0.08	Same as Mattoon.	Permanent jobs: 200 Induced jobs: 113 Percent increase workers: 0.09	Permanent jobs: 200 Induced jobs: 113 Percent increase workers: 0.18
Impact to housing market: Percent decrease for sale: 2.2 Percent decrease for rent: 0.4	Impact to housing market: Percent decrease for sale: 3.0 Percent decrease for rent: 1.3	Impact to housing market: Percent decrease for sale: 4.5 Percent decrease for rent: 0.8	Impact to housing market: Percent decrease for sale: 7.8 Percent decrease for rent: 3.9

Table S-12. Summary Comparison of Impacts

Mattoon	Tuscola	Jewett	Odessa
Proposed Action – Environmental Justice			
Construction: No disproportionately high and adverse impact to minority populations. No such populations are present as defined under Executive Order (EO) 12898 within the ROI.	**Construction:** Same as Mattoon.	**Construction:** Minority populations are interspersed within the ROI, however, impacts would not be considered disproportionately high and adverse under EO 12898.	**Construction:** Same as Jewett.
Low-income populations are located within the ROI when compared to regional and national percentages; however, impacts would not be considered disproportionately high and adverse under EO 12898. Short-term job creation during construction.	Same as Mattoon.	Same as Mattoon.	Same as Mattoon.
Operations: Aesthetics, transportation, noise, and socioeconomic impacts resulting from operations were determined not to have a disproportionately high and adverse effect to minority or low-income populations.	**Operations:** Same as Mattoon.	**Operations:** Noise impacts resulting from operations were determined not to have a disproportionately high and adverse effect to minority or low-income populations.	**Operations:** Aesthetics and noise impacts resulting from operations were determined not to have a disproportionately high and adverse effect to minority or low-income populations.
Long-term job creation during operation may benefit low-income populations.	Long-term job creation during operation may benefit low-income populations.	Long-term job creation during operation may benefit low-income populations.	Long-term job creation during operation may benefit low-income populations.
The potential risks to health, although unlikely, were determined to be from a slow, upward leak of H_2S from an injection or existing well. A potential risk could also occur from a catastrophic accident; however, the risk of terrorism or sabotage events cannot be predicted. An ammonia spill from a tank valve, a tanker truck spill, and a tank rupture is also a potential risk. This potential would be uniform with the general population and, therefore, no disproportionately high and adverse impacts are anticipated to minority or low-income populations.	The potential risks to health were determined to be from the unlikely event of a pipeline rupture or puncture and the extremely unlikely event of a slow, upward leakage of H_2S from an injection or existing well, or a catastrophic accident; however, the risk of terrorism or sabotage events cannot be predicted. An ammonia spill from a tank valve, a tanker truck spill, and a tank rupture is also a potential risk. This potential would be uniform with the general population and, therefore, no disproportionately high and adverse impacts are anticipated to minority or low-income populations.	The potential risks to health were determined to be from the unlikely event of a pipeline rupture or puncture, the extremely unlikely event of a wellhead equipment rupture, and a catastrophic accident; however, the risk of terrorism or sabotage events cannot be predicted. An ammonia spill from a tank valve, a tanker truck spill, and a tank rupture is also a potential risk. This potential would be uniform with the general population and, therefore, no disproportionately high and adverse impacts are anticipated to minority or low-income populations.	The potential risks to health were determined to be from a catastrophic accident; however, the risk of terrorism or sabotage events cannot be predicted. An ammonia spill from a tank valve, a tanker truck spill, and a tank rupture is also a potential risk. This potential would be uniform with the general population and, therefore, no disproportionately high and adverse impacts are anticipated to minority or low-income populations.

S.9.1 INCOMPLETE AND UNAVAILABLE INFORMATION

Under NEPA, federal agencies must disclose incomplete or unavailable information, if such information is essential to a reasoned choice among alternatives, when evaluating reasonably foreseeable significant adverse impacts on the human environment in an EIS and obtain that information if the overall costs of doing so are not exorbitant (40 CFR 1502.22).

Because the FutureGen Project would be conducted to research and develop technologies related to coal gasification, power generation, and carbon capture and sequestration, the project's objective is to fill existing knowledge gaps and generate data that are currently unavailable with regard to these technologies.

There is some uncertainty related to the results of subsurface modeling of injected CO_2 due to the constraints of current computer model capabilities and the need for additional site specific geologic data. Some information is unavailable or incomplete due to the high costs involved in obtaining data for all the candidate sites, such as geologic data that can only be gathered through drilling wells thousands of feet deep. Under this example, subsurface data would be collected for the chosen site. For the purposes of this EIS, best available geologic data and professional judgment were used to select the parameters within the models.

The FutureGen Project is in the initial conceptual design phase, and the configuration, goals, and research plans for the project have not been finalized. Therefore, unavailable and incomplete information regarding project features as they relate to some environmental resources would only become available at a later stage of design and site characterization. For example, since conceptual site plans for each of the proposed site are not available, DOE conservatively assumed an upperbound land disturbance footprint of 200 acres (81 hectares). Where a high degree of uncertainty existed regarding the power plant's ultimate design, features and utility connections, a range of parameters or conditions were analyzed representing an upper bound for estimating potential impacts.

Key areas of incomplete and unavailable information include:

- Presence of undetected faults, wells penetrating the primary seal, or other subsurface pathways of potential leakage of sequestered CO_2.
- Porosity, permeability and thickness of the target Mt. Simon formation at Mattoon and Tuscola.
- Permeability and injectivity of the Lower Queen and Delaware Mountain Group sandstones at the Odessa injection site.
- Effects of CO_2 sequestration on deep subsurface microbial communities.
- Maximum and steady-state air emissions of the FutureGen Project.
- ***Design and construction details of the on-site wastewater systems that will employ standard industry practices to achieve zero liquid discharge at Jewett and Odessa.***
- Disposition and quantity of saline water extracted from the sequestration reservoir at Jewett.
- Degree of visual screening and architectural design of the power plant.
- Exact quantities of materials delivered and byproducts produced, their method of transportation, and the disposition of waste.
- Exact noise profiles of power plant equipment, their proximity to nearby receptors and types and quantities of construction equipment.
- Current and future water levels in potentially affected streams near the Mattoon and Tuscola sites.
- Recent LOS data at each site's closest road intersections and related traffic accident data.
- Approved interconnection voltage and transmission line corridors.

Section 3.2 of the EIS provides further explanation of these areas. Overall, DOE has overcome the lack of a final power plant site design or site-specific information by making conservative yet reasonable assumptions based on similar projects, professional judgment, and the extrapolation of best available data.

S.10 POTENTIAL CUMULATIVE IMPACTS

This section describes potential cumulative impacts (40 CFR 1508.7) that may result from the FutureGen Project when combined with the impacts of other relevant past, ongoing, and reasonably foreseeable future actions near the candidate sites. The CEQ regulations implementing NEPA require the consideration of cumulative impacts as part of the EIS process. DOE considers a reasonably foreseeable action to be a future action for which there is a reasonable expectation that the action could occur, such as an action under analysis by a regulatory agency, a proposal being considered by a state or local planning organization, a project that has commenced, or a future action that has obligated funding.

Actions or activities relevant to the FutureGen Project include those related to power generation, coal production, geologic sequestration, transportation, air emissions (associated with large quantity generators), and statewide initiatives related to these areas. The existing environment with respect to oil and coalbed methane resources is also discussed in terms of their potential recovery through CO_2 sequestration.

S.10.1 CUMULATIVE IMPACTS OF FUTUREGEN TECHNOLOGY

The FutureGen Project would be a research and development project for testing advanced coal gasification, power generation, and geologic sequestration technologies. Collectively, the research, development, and operational experience gained through the FutureGen Project, other current and planned coal gasification plants, and geologic sequestration projects could foster increasing numbers of new IGCC power plants with sequestration components, as well as the retrofitting of existing power plants with sequestration components. The subsequent reduction in anthropogenic GHG emissions that would otherwise be emitted by traditional coal-fueled power plants would be a beneficial cumulative impact.

The ability to effectively and economically capture CO_2 emissions from existing power plants could spur the construction of new CO_2 pipelines across the country to geologic formations suitable for CO_2 sequestration. In the near term, it is likely that the most economical geologic sequestration projects would support EOR or enhanced coalbed methane (ECBM) operations. However, if CO_2 becomes a regulated air pollutant in the U.S. in the future, sequestration in deep saline aquifers (which are generally more geographically dispersed throughout the U.S. than oil and gas reservoirs) may become more likely targets for carbon sequestration.

After the DOE-sponsored phase of the project, the Alliance could choose the types of research projects conducted at the plant and the operating features of the plant. It is reasonably foreseeable that, over time, the Alliance or its successor would alter key aspects of plant operation based on economic factors. For example, to lower operating costs, the Alliance could choose to co-sequester H_2S with the CO_2 gas, thus eliminating the cost of operating the Claus process. Implementation of a full co-sequestration option may require pipeline upgrades or potential additional monitoring procedures.

The Alliance or its successor may also choose to sell the CO_2 for use in EOR. Although it is not a required aspect of the candidate sites, the potential to use CO_2 for EOR may be considered a "best value" aspect. The ability to transport and sell all or a portion of the CO_2 could offset operating expenses of the FutureGen Project. All four of the candidate sites have oil fields within 50 miles (80.5 kilometers). The most likely scenario for using the FutureGen CO_2 for EOR would be for the Alliance to negotiate an agreement with an existing commercial oil field operator or pipeline company. Under such an agreement, the Alliance would sell the CO_2, and construction and operation of the pipeline and the injection site would be the responsibility of the buyer.

In Odessa, a commercial CO_2 pipeline is located near the proposed Odessa Site that transports CO_2 to local oil fields. At the other candidate sites, a new pipeline route (in addition to that planned for the saline formation injection site) would be required to reach local oil fields. The length and route of any new pipeline would depend on the site chosen to receive the CO_2.

The use of CO_2 from the power plant at existing oil fields could extend the operating life of those fields, allowing for greater volumes of oil to be extracted. A small fraction of the CO_2 would mix with the recovered oil, but would be removed in the processing stage. However, because of the economic value of the CO_2, it would most likely be recovered and re-injected at the EOR site. Extending the life of nearly-depleted oil fields could create or prolong existing jobs at these fields and provide additional oil and gasoline for consumers. Impacts associated with using the CO_2 for EOR could potentially include (but would not be limited to):

- Developing ROWs for new CO_2 pipelines that could cause changes in land use and ownership, land clearing and soil disturbance, utility and road crossings, wetland disturbance, habitat disturbance, and potential surface leaks of CO_2.
- Constructing new CO_2 injection sites that require the permitting and drilling of new UIC wells; land clearing and soil disturbance for installing wells, pumps, distribution piping, access roads, and utility lines; ***and*** sealing or mitigation of abandoned wells**.**
- ***Potential surface leaks of sequestered CO_2; potential vertical or lateral migration of CO_2 in the subsurface that could cause changes in soil gas concentrations, cause chemical changes or mineralization, impact groundwater supplies, or mobilize heavy metals.***
- ***Prolonging oil recovery operations at the site.***
- ***Providing the economic benefits of additional oil recovery.***

Based on local markets for hydrogen gas, the Alliance may choose to sell a portion of the H_2 gas stream as a commercial commodity in the future. This process may include transporting it off site or providing a fill station at the plant site. The Alliance would not maintain a large storage tank for the H_2.

S.10.2 REASONABLY FORESEEABLE FUTURE ACTIONS NEAR ALTERNATIVE SITES

This section discusses relevant and reasonably foreseeable future actions within an ROI which is identified to be the region within a radius of 50 miles (80.5 kilometers) from each of the candidate sites. The environmental resource-specific ROIs discussed in the EIS range from the power plant site and sequestration site locations to 50 miles (80.5 kilometers) from each of the candidate sites. The ROI varies in distance depending on the specific resource area (see specific resources evaluated in Chapters 4 through 7). These actions, when considered in context with impacts expected for each alternative site, would have the potential to result in cumulative impacts. These major actions generally fall into the categories of other planned conventional power plants, alternative energy projects, sequestration projects, coal mining, and transportation projects. Because the Mattoon and Tuscola candidate sites are within approximately 25 miles (40 kilometers) of one another, many of the reasonably foreseeable actions are common to their respective ROIs and are discussed together.

Table S-13 summarizes reasonably foreseeable projects identified within 50 miles (80.5 kilometers) the ROI of the Mattoon and Tuscola candidate sites.

Table S-13. Reasonably Foreseeable Projects within the Mattoon and Tuscola, Illinois ROIs

Project	Description
Fossil Fuel Power Plants	
The Taylorville Energy Center (TEC)	The TEC, a 660-MWe IGCC power plant, is planned for a 329-acre (133-hectare) site situated northeast of Taylorville in Christian County. The property is located immediately north of the planned Christian Coal mine site.
Alternative Energy Projects	
Biofuels Company of America, LLC	Biofuels Company of America, LLC, proposes to construct a bio-diesel production facility in Danville capable of producing 45 million gallons (170 million liters) of fuel per year, using the equivalent of 30 million bushels of soybeans.
Illinois Clean Fuels	Illinois Clean Fuels proposes to construct a coal-to-bio-diesel fuel plant that would use coal gasification technology similar to that proposed for the FutureGen Project. The plant would convert 4.3 million tons (3.9 MMT) of coal from a new mine into 385 million gallons (1,457 million liters) of fuel per year. Illinois Clean Fuels expects the plant to be operational by 2012 and create 600 jobs (Mitchell, 2006).
Diamond Ethanol Plant	The Diamond Ethanol Plant is proposed to be constructed in Charleston, in Coles County and would produce 60 million gallons (227 million liters) of ethanol from 21 million bushels of corn per year using natural gas as fuel. The plant would include a new rail siding.
Illini Ethanol, LLC	Illini Ethanol, LLC, proposes to construct an ethanol manufacturing plant near Royal, in Champaign County. The plant would produce up to 110 million gallons (416 million liters) of ethanol per year and would use natural gas as fuel.
Andersons Champaign Ethanol	The Andersons Champaign Ethanol is a proposed natural-gas-fueled ethanol plant in Champaign, which would be capable of producing up to 125 million gallons (473 million liters) of ethanol per year (IEPA, 2006). Local residents have raised environmental concerns about the proposed project, particularly with respect to the proposed plant drawing approximately 1 million gallons (3.7 million liters) of water per day from the Mahomet Aquifer (Carter, 2006).
Danville Renewable Energy, LLC	Danville Renewable Energy, LLC, proposes to construct a natural-gas-fueled ethanol plant in Danville, Vermilion County. The plant would convert 40 million bushels of corn into 200 million gallons (257 million liters) of ethanol per year (Binder, 2006).
Twin Groves Wind Farm	Twin Groves Wind Farm, which is expected to become operational in 2007, will offer 396 MW of energy produced from 240 wind turbine generators. The wind farm is expected to remove 150 to 200 acres (61 to 81 hectares) of land from crop production (Horizon Wind Energy, 2005).
Emerald Renewable Energy –Tuscola, LLC	An ethanol plant is being planned near the Tuscola Site. Although an air permit was submitted to the Illinois Environmental Protection Agency (IEPA) on December 22, 2006, there is currently no construction schedule. This proposed plant would use corn as feedstock and would produce 100 million gallons (378 million liters) of ethanol per year. The facility would use natural gas boilers.

Table S-13. Reasonably Foreseeable Projects within the Mattoon and Tuscola, Illinois ROIs

Project	Description
Geologic Sequestration Projects	
Midwest Geological Sequestration Consortium (MGSC) CO_2 Sequestration Projects	In the Illinois Basin, the MGSC will determine the ability, safety, and capacity of geological reservoirs to store CO_2 in deep coal seams, mature oil fields, and deep saline reservoir formations. Each of these projects will obtain CO_2 from ethanol plants or refineries in Illinois and Indiana. One of the five potential sites for the field testing is Mattoon Field in Coles County, Illinois, which is located within 10 miles (16.1 kilometers) of Mattoon and within 25 miles (40.2 kilometers) of Tuscola (NETL, 2006a).
CO_2 Pipeline	As part of the State of Illinois' Governor's Energy Independence Plan, a 140-mile (225-kilometer) CO_2 pipeline would connect planned coal gasification plants to EOR and ECBM areas in southeastern Illinois. A route and timeline have not been determined.
Transportation Projects	
Illinois Department of Transportation (IDOT) Proposed Highway Improvement Plan (IDOT, 2006)	There are numerous IDOT projects planned in the ROI for both the Mattoon and Tuscola sites. Most of these projects are for roadway and bridge maintenance including resurfacing, shoulder reconstruction, and rail crossing improvements. More substantive projects include a bridge replacement on I-130 in Olney, for US 40 over the Union Pacific Railroad, and at the CSX Railroad and US 36.
CR 1000N proposed upgrade between Charleston and Mattoon	A proposed upgrade to CR 1000N between Charleston and Mattoon would interchange with I-57. It is expected that the new interchange of I-57/CR 1000N would result in immediate development pressures nearby and eventual development along other portions. CR 1000N connects the industrial developments north of Charleston and Mattoon with I-57.
Proposed improvement of CH 13 to a Class II truck route from CH 18 to the entrance of the proposed Mattoon Power Plant Site, including the intersection with SR 121	The IDOT has scheduled future construction to improve CH 13 to a Class II truck route from CH 18 to the entrance of the proposed Mattoon Power Plant Site, including the intersection with SR 121. This construction is already being planned and is not related to the Proposed Action. This new construction would consist of 1.25 miles (2.0 kilometers) of roadway widening and resurfacing with new shoulders and ditches. The intersection of SR 121 and CH 13 would be rebuilt so CH 13 approaches at right angles. A turn lane would also be built on SR 121.

Table S-14 summarizes reasonably foreseeable projects identified within 50 miles (80.5 kilometers) of the Jewett candidate site.

Table S-14. Reasonably Foreseeable Projects within the Jewett, Texas ROI

Project	Description
Fossil Fuel Power Plants	
NRG Limestone Electric Generating Station	800-MW lignite coal-fueled boiler (Unit 3) at the existing plant in Jewett, Texas, adjacent to the Jewett Site. Expected operation date is 2012.
Oak Grove Mgmt. Co., LP (TWU)	1600-MW lignite coal-fueled power plant located in Robertson County. Site would be 12 miles (19.3 kilometers) north of Franklin, Texas and 12 miles (19.3 kilometers) southwest of the Jewett Site. Expected operation date is 2009. This project would be near the existing Calvert coal mine.
Sandow 5 (replaces ALCOA units)	434-MW lignite coal-fueled power plant located in Rockdale, Milan County, Texas. Proposed plant would be 50 miles (80.5 kilometers) southwest of the Jewett Site. Expected operation date is 2007.
Sandy Creek Energy Associates., LP	600-MW coal-fueled power plant that would use PRB coal. Plant location would be 31 miles (49.9 kilometers) northwest of the Jewett Site on Rattlesnake Road in Riesel, McLennan County, Texas. Expected operation date is 2008.

Table S-14. Reasonably Foreseeable Projects within the Jewett, Texas ROI

Project	Description
Twin Oaks Power III, LP (Sempra)	600-MW lignite coal-fueled power plant that would be located in Robertson County, Texas, 8 miles (12.9 kilometers) north of Calvert and 31 miles (49.9 kilometers) north of the Jewett Site. Expected operation date is 2010. This project would be near the existing Twin Oaks coal mine.
Alternative Energy Projects	
No projects identified	
Geologic Sequestration Projects	
Gulf Coast Basin, Southeast Regional Carbon Sequestration Partnership	In the Gulf Coast Basin, the Southeast Regional Carbon Sequestration Partnership will build upon the Frio Basin Project by testing a model for early CO_2 injection into an oil reservoir, followed by long-term, large-volume storage in underlying brine formations. Fifteen potential sites for the project have been identified and the selected site has yet to be determined (NETL, 2006b).
Transportation Projects	
FM 39 Relocation	The Texas Westmoreland Coal Company plans to relocate a section of FM 39 and the current train overpass to reclaimed land to facilitate the continuation of mining operations. This relocation is scheduled to begin in 2007 and be completed in approximately 1 year (FG Alliance, 2006e).
Texas Department of Transportation (TxDOT) roadway improvements (widening or new roads)	There are numerous TxDOT projects planned in the ROI, including improvements to FM 60 from FM 50 to Snook, FM 2154 from FM 2818 to SH 40, SH 21 from Kurten to the Navasota River, SH 6 from Hearne to Calvert, FM 60 from SH 6 to FM 158, US 79 Rockdale Relief Route, and SH 249 from Montgomery County to SH 6 (FG Alliance, 2006e).
Trans-Texas Corridor (TTC-35)	TxDOT is evaluating TTC-35 that would parallel the existing I-35 from the Oklahoma border through Central Texas to the border with Mexico. If developed, this corridor would run north-south approximately 40 miles (64.4 kilometers) west of the Jewett Site. Construction could begin in 2011 pending environmental clearance to determine the corridor's ultimate alignment (TxDOT, 2006).

Source: Alamo Area Council of Governments, 2006.

The planned coal-fueled power plants listed in Table S-14 are those within 50 miles (80.5 kilometers) of the proposed Jewett Power Plant Site. However, there are several similar power plants currently proposed in the northeastern portion of Texas. Concerns have been raised by the public and environmental organizations regarding cumulative impacts to air quality resulting from operation of all of these proposed coal-fueled power plants.

In addition to the projects listed in Table S-14, the existing NRG Limestone Electric Generating Station in Jewett will be the site of a DOE Clean Coal Power Initiative (CCPI) project, "Mercury Species and Multi-Pollutant Control," under a cooperative agreement signed in April 2006 with DOE. Performance testing of the project is expected to begin in October 2008 and last 38 months. The project will demonstrate advanced sensors and neural network-based optimization and control technologies for enhanced Hg and multi-pollutant control on its existing 890-MW boiler. The technology, once demonstrated, should have broad application to existing coal-fueled boilers and provide positive impacts on the quality of saleable byproducts, such as fly ash (NETL, 2006c).

Table S-15 summarizes reasonably foreseeable projects identified within 50 miles (80.5 kilometers) of the Odessa candidate site.

Table S-15. Reasonably Foreseeable Projects within the Odessa, Texas ROI

Project	Description
Fossil Fuel Power Plants	
Navasota Energy's Quail Run Energy Center	550-MW natural-gas-fired power plant currently under construction in the Odessa Business Park, approximately 19 miles (30.6 kilometers) to the northeast of the Odessa Site. Expected completion date is 2008 (Reuters, 2006). The plant would be able to transport power to Houston or Dallas markets on existing grids.
Alternative Energy Projects	
Forest Creek Wind Farm	125-MW wind farm located on remote ranchland approximately 50 miles (80.5 kilometers) east of the Odessa Site. Expected operation date is the end of 2006 (Wells Fargo, 2006).
Major Energy Diversification Plan	On October 2, 2006, the Governor of Texas announced a Major Energy Diversification Plan that would invest $10 billion in wind energy projects through a public-private initiative (Texas Office of the Governor, 2006). This initiative could promote the construction of additional wind farms in west Texas.
Geologic Sequestration Projects	
Scurry Area Canyon Reef Operators Committee (SACROC)	Southwest Regional Partnership for Carbon Sequestration will perform post-audit modeling analysis of injected CO_2 for EOR at the SACROC Unit over the last 30 years. This will help define a working model for the nearby Claytonville field, an area with similar geology that has not been subject to CO_2 injection (NETL, 2006c).
Transportation Projects	
La Entrada al Pacifico Rail Corridor	There is a proposal for a new rail corridor between the U.S. and Mexico that would connect the Midland-Odessa area of west Texas to the South Orient rail line. This line would be part of the La Entrada al Pacifico (Entrance to the Pacific) trade corridor. This proposed rail corridor would connect the South Orient between Rankin and McCamey, and would enable freight to travel from northwest Texas and the Panhandle to the border at Presidio (TxDOT, 2005).

S.10.3 POTENTIAL CUMULATIVE IMPACTS FOR ALTERNATIVE SITES

The following sections describe potential cumulative impacts that could occur at each of the candidate sites. These impacts are principally related to the potential for additional air emissions, increases in traffic and noise along transportation corridors that are common to the FutureGen Project, and the consumption of local resources within the ROIs.

S.10.3.1 Mattoon and Tuscola

One new coal IGCC plant (TEC) is proposed approximately 50 miles (80.5 kilometers) west of Mattoon and several alternative energy projects (e.g., bio-diesel and ethanol plants) are within 50 miles (80.5 kilometers) of Mattoon and Tuscola (see Table S-13). The primary concern regarding these projects is the potential for cumulative air emissions. Based on the maximum estimate emissions rates, the largest contribution of air pollutants related to the FutureGen Project would be NO_x, SO_x and CO. The FutureGen Project would contribute up to 36 percent and 40 percent of the cumulative NO_x and SO_x emissions respectively, and up to 27 percent of cumulative CO emissions. The Mattoon and Tuscola power plant sites are in attainment areas and are substantially below the NAAQS for these pollutants. Therefore, the cumulative impact from NO_x, SO_x, and CO emissions from these projects would not be expected to exceed NAAQS. Ambient concentrations of $PM_{2.5}$ are much closer to the NAAQS, and cumulative air emissions from proposed facilities in the region would likely cause the $PM_{2.5}$ concentrations to increase. Detailed modeling of all the proposed sources, along with the existing sources and local air quality data, would be required to estimate more accurately whether the cumulative impact of the proposed sources could result in the $PM_{2.5}$ standard being exceeded. However, the FutureGen Project would represent less than 10 percent of the estimated future emissions of PM for the maximum case, and approximately 3 percent for the target case.

For Mattoon, there would be no ***use of*** groundwater ***for process water for the FutureGen Project***. At Tuscola, under low-flow periods, the Kaskaskia River water that would serve as the plant's process water could be augmented with water drawn from the Mahomet Aquifer. Cumulatively, the Tuscola project, along with other foreseeable projects (e.g., Andersons Champaign Ethanol project; Ethanol Plant, Tuscola) ***and projected population growth in the communities north of Douglas County*** could reduce water levels locally in the Mahomet Aquifer. ***It is unknown to what extent the proposed ethanol plants would use surface water instead of groundwater for their operations. It is likely, however, that water levels in the Kaskaskia River near the Tuscola site could increase in the future due to increased effluent from the upstream Urbana/Champaign Sanitation District treatment facility, as a result of population growth in that District.***

Although the construction of most of these plants (TEC and ethanol/bio-diesel plants) would be completed by the time the FutureGen Project would begin construction, it is possible that, in the short-term, these projects would compete with the FutureGen Project for resources such as construction labor and local construction supplies. Collectively, they may increase short-term construction road traffic impacts in terms of truck deliveries and commuter vehicles. Over the long-term, these projects would collectively increase both rail shipments and truck shipments on local highways. The increase in rail and truck shipments for these projects could result in increases in noise along their respective rail and road corridors.

As shown in Table S-13, a number of transportation projects would occur in the ROI. However, these projects are primarily for roadway improvements and maintenance activities that would be expected to improve roadway conditions over time. Although traffic from the FutureGen Project could exacerbate short-term impacts from roadway construction activities and associated detours, the impacts are expected to be minor and short-term in nature.

In addition, as with many development activities in this region, more prime farmland may be converted and lost due to land disturbance and construction activities. As discussed in the Land Use resource sections for Mattoon and Tuscola (Sections 4.11 and 5.11, respectively), approximately 27,060 acres (10,951 hectares) of prime farmland are lost per year in Illinois. The TEC and various ethanol/bio-diesel projects planned for the area may lead to loss of prime farmland, depending on their location. The FutureGen Project would cause the loss of up to 200 acres (81 hectares) of prime farmland.

With the initiatives currently in place to promote use of Illinois Basin Coal and the advancement of clean coal technologies that make the use of this coal feasible, coal mining within the region could increase over time. As a potential consumer of Illinois Basin coal, the FutureGen Project could provide additional incentive for certain coal mining activities in the region. However, this would largely be based on future decisions of the Alliance and any subsequent owners on the degree to which it chooses to use a particular coal or coal source.

There are numerous opportunities for EOR in the Mattoon and Tuscola ROI. Opportunities also exist for ECBM recovery throughout the region. Over time, it is possible that new EOR or ECBM projects could emerge as a result of new CO_2 streams in the region, including those from the proposed ethanol plants and possibly the FutureGen Project. This is evidenced by an initiative announced in November 2006 to construct a 140-mile (225-kilometer) CO_2 pipeline for EOR and ECBM. The potential cumulative impacts resulting from these undertakings would principally be related to construction of the necessary infrastructure to transport the CO_2 to the injection locations, as well as the activities that would occur at injection and recovery sites.

Additional geologic sequestration research activities within the Illinois Basin are being undertaken by the MGSC that would inject CO_2 into deep coal seams, mature oil fields, and deep saline formations. The MGSC estimates that there are over 45 billion tons (41 billion metric tons) of CO_2 storage capacity within the Illinois Basin. Of this capacity, 8.6 billion tons (7.8 billion metric tons) lie within deep saline formations (e.g., Mt. Simon and St. Peter formations) (MGSC, 2005). The FutureGen Project would use 0.64 percent of this saline formation capacity. Thus, while the FutureGen Project would subtract from available capacity, it would have a negligible impact on the ability of other sequestration projects to occur within the region.

The FutureGen Project could result in the future clustering of other industries on or around the selected site. At the Mattoon Site, this would cause further alteration of the character of the landscape. At the Tuscola Site, where existing and planned chemical plants are already located nearby, this change would be less intrusive. Such growth has the potential for displacing additional prime farmland in the vicinity of either Illinois site. The clustering of industry would introduce new air emission sources, truck and rail traffic, and noise that may degrade the environment.

S.10.3.2 Jewett

Five new coal-fueled power plants in various stages of planning and permitting are located within a 50-mile (80.5-kilometer) radius of the proposed Jewett Power Plant Site (see Table S-14). In addition, the NRG Limestone Electric Generating Station plans to add a lignite-fired boiler and 800-MW electric generating unit. Based on planning data, all of these plants ***could*** begin operation before the completion of the FutureGen Project.

Cumulative air quality impacts within the ROI for the Jewett Site would largely be driven by the combined emissions of these proposed facilities, which would be expected to be substantially greater than the emissions potential for the FutureGen Project. Should the projects go forward, they would release tens of thousands of tons of criteria pollutants into the atmosphere, which could adversely affect air quality. The FutureGen Project would contribute up to ***5*** percent and ***1.7*** percent of the cumulative NO_x and SO_x emissions, respectively, and up to ***1.1*** percent of cumulative CO emissions. Because the Jewett Site is in an attainment area that is substantially below the NAAQS for these pollutants (see Section 6.2), the cumulative impact from NO_x, SO_x, and CO emissions from the FutureGen Project would not be expected to exceed NAAQS. Ambient concentrations of $PM_{2.5}$ ***may be*** much closer to the NAAQS ***(based on the closest PM monitoring station, which is located near Houston, a more urban area)***, and cumulative air emissions from proposed facilities in the region would likely cause the $PM_{2.5}$ concentrations to increase. Detailed modeling of all the proposed sources, along with the existing sources and local air quality data, would be required to estimate more accurately whether the cumulative impact of the proposed sources could result in the $PM_{2.5}$ standard being exceeded. However, the FutureGen Project would represent less than 1***.4*** percent of the estimated future emissions of PM within 50 miles (80.5 kilometers) of Jewett.

Based on a nominal rate of 2 pounds of CO_2 generated for each kilowatt-hour for a pulverized coal power plant (EPA, 2006), the other power plants within the Jewett ROI would emit approximately ***35*** million tons (3***1.7*** million metric tons) of CO_2 annually.

In addition to the potential for cumulative air quality impacts, activities associated with the construction and operation of a new 800-MW unit at the adjacent NRG Limestone Electric Generating Station could result in additional traffic and noise in the immediate vicinity of the Jewett Site. However, it is expected that these increases would be localized. Because there are few receptors in this area and traffic conditions are generally acceptable, these impacts are not expected to be severe.

The proposed TTC-35 (which would run north-south approximately 40 miles [64.4 kilometers] to the west of Jewett) could cause impacts during its construction in the form of regional traffic delays and detours. However, after its completion, this corridor would alleviate traffic and have a net positive impact on transportation in the region. The Texas initiative to move freight lines away from heavily populated areas, such as Dallas to the north, Houston to the south, and Austin to the southwest, may cause temporary rail delays during construction, but would have long-term positive impacts on rail shipments in the region.

Numerous opportunities exist for EOR in the Jewett ROI. Over time, it is possible that additional EOR projects could emerge as a result of new CO_2 streams in the region. The potential cumulative impacts resulting from any EOR undertakings would principally be related to construction of the necessary infrastructure to transport the CO_2 to the injection locations and the activities that would occur at injection and recovery sites.

Water availability in Texas is a chief concern in terms of cumulative impacts of new projects. The water required by other projects in the ROI (such as the proposed power plants) and their sources are unknown, but could reduce water availability in the region. ***The proposed Jewett site would be located in Limestone, Freestone and Leon counties, where each county lies within different water planning regions (G, C, H respectively). Based on the state predictions of water use through 2060, water demand would increase in these planning areas by 38, 87 and 47 percent respectively, attributed largely to municipal demand (residential population growth). Across the three planning areas, existing surface water supplies would decrease by 4 percent and groundwater supplies would decrease by 17 percent by 2060. In planning region G, the Carrizo-Wilcox aquifer water supply would decrease by 13 percent by 2060.***

The withdrawal of ***3.1 billion gallons (4.9 billion liters) or 4,000 acre-feet of water annually*** for the FutureGen Project could affect future groundwater supplies locally. ***Based on the 2007 State Water Plan, the FutureGen Project would consume approximately 4 percent of the Carrizo-Wilcox Aquifer annual supply within planning region G.*** The Jewett Site would have an on-site wastewater treatment facility and it is probable that the effluent would be recycled into the power plant. This would be consistent with the recommendations of the 2007 State Water Plan. Texas is continuing to work on the restoration of the Trinity River. The FutureGen Project would use BMPs during construction of the CO_2 pipeline and sequestration facilities to minimize impacts to the river's water quality.

The FutureGen Project could result in the future clustering of other industries on or around the selected site. For the Jewett Site, which is already surrounded by existing industry with few residences nearby, this change would not be considered intrusive. The clustering of industry would introduce new air emission sources, truck and rail traffic, and noise that may degrade the environment. However, such development would be consistent with the ongoing Texas Industry Cluster Initiative (Texas Office of the Governor, 2004).

S.10.3.3 Odessa

Only one major fossil fuel energy project is planned within the ROI for the Odessa Site, and few other projects in the vicinity have the potential to result in cumulative impacts (see Table S-15). A natural-gas-fueled power plant is currently under construction 19 miles (30.6 kilometers) northeast of the Odessa Site, and no cumulative air quality impacts are expected from this project and the FutureGen Project.

In general, West Texas has favorable conditions for wind energy. A wind farm is proposed approximately 50 miles (80.5 kilometers) east of the site and wind farms are located within a few miles of the Odessa Sequestration Site. Based on the state's Energy Diversification Plan and clean energy law, future construction of additional wind farms near the Odessa Site is highly likely. These projects would provide clean, renewable energy that could possibly replace the energy provided by aging fossil fuel power plants in the future.

A new rail trade corridor (La Entrada al Pacifico), including a major new highway, highway and rail upgrades, and an inland port facility, is proposed between the U.S. and Mexico that would connect the Midland-Odessa area of west Texas to the South Orient rail line to Mexico's Pacific coast. Should this project go forward, it may expand the availability of freight routes in the area around the proposed Odessa Site, allowing for greater flexibility and lower cost of deliveries to and from the plant site.

Numerous opportunities exist for EOR in the Odessa ROI. Over time, it is possible that projects could emerge as a result of new CO_2 streams in the region. The potential cumulative impacts resulting from any EOR undertakings would principally be related to construction of the necessary infrastructure to transport the CO_2 to the injection locations and the activities that would occur at injection and recovery sites. It is expected that geologic sequestration research and projects would also continue in the ROI, including those under DOE's Carbon Sequestration Program. Because of the abundant land area and suitable geologic conditions in the Odessa area, the FutureGen Project would not limit future sequestration activities in the region.

Water availability in West Texas is a chief concern in terms of cumulative impacts of new projects. Although few large projects are proposed within the ROI that would consume water, the withdrawal of ***3.1 billion gallons (4.9 billion liters) or 4,000 acre-feet of water annually*** for the FutureGen Project could affect future groundwater supplies. Although the Texas Water Development Board has indicated that a number of existing well fields could provide sufficient water for the FutureGen Project, regional population and industry growth over time may strain water supplies in the future. ***The proposed Odessa Site is located in water planning region F, where projected water demand between 2010 and 2050 is expected to increase by only 2 percent. Approximately 75 percent of current water demand is associated with agricultural irrigation and 78 percent of the region's existing water supply consists of groundwater from the Ogallala, Edwards-Trinity, Trinity and Pecos Valley aquifers. Water conservation strategies for the region include advanced irrigation methods and reuse of treated municipal wastewater. The region is also looking to desalinate brackish groundwater and add new well fields for Midland and San Angelo. Based on existing groundwater supplies in the region (all aquifers), the FutureGen Project would use approximately 1 percent of the annual groundwater supply.***

The FutureGen Project could result in the future clustering of other industries on or around the selected site. For the Odessa Site, which is surrounded by existing industry and oil and gas fields, this change would not be considered intrusive. The clustering of industry would introduce new air emissions sources, truck and rail traffic, and noise that may degrade the environment. However, such development would be consistent with the ongoing Texas Industry Cluster Initiative (Texas Office of the Governor, 2004).

S.11 UNAVOIDABLE ADVERSE IMPACTS AND MITIGATION MEASURES

For all environmental resources, the mitigation of potential adverse impacts from project activities would be achieved through various mitigation measures that are generally required by permitting processes and other federal, state, or municipal regulations and ordinances. Table S-16 outlines mitigation measures that the Alliance may use to offset potential adverse impacts from the FutureGen Project.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Air Quality	**Construction/Operations:** • The FutureGen Project would result in emissions of criteria and hazardous air pollutants, including those from unplanned restarts and flaring events. During these events, intermittent increases of steady-state emissions would occur when process gases are flared for a short period of time to restart the operations. It is not possible to predict the number and nature of unplanned restarts due to plant upsets that could occur. There would be concentrations of pollutants resulting in short-term impacts; however, the peak concentration of pollutants emitted would be within a 2-mile (3.2-kilometer) radius at any of the proposed sites. Residences within that radius would be most affected during unplanned restart and flaring events.	**Operations:** • The FutureGen Project would employ the most advanced particulate control technologies available. Concentration of particulates in the cleaned syngas would be about 0.1 to 1 parts per million by weight, far lower than current environmental standards. • The project would use the most advanced combustion control technologies for NO_X available when the turbine would be put into service. SCR is considered a possible option if suitable conditions exist to minimize potential interference by sulfur species. • The project would include a water-gas-shift reactor, plus an AGR system which would capture and remove acidic gases such as CO and H_2S.
Climate and Meteorology	**Construction/Operations:** • Construction and operation of the proposed facility would not cause any unavoidable adverse impacts relevant to climate and meteorology.	**Construction/Operations:** • No mitigation measures warranted.
Geology	**Construction/Operations:** • No unavoidable adverse impacts would occur to geological resources. Reservoir space would be used to store the injected CO_2. • May cause local adverse impacts to and loss of microbial communities that live in rock where CO_2 would be injected.	**Construction/Operations:** • No mitigation measures warranted.
Physiography and Soils	**Construction:** • Unavoidable soil disturbance at the proposed power plant site would result in permanent removal or displacement of soils on up to 200 acres (81 hectares); this includes prime farmland soils (Mattoon and Tuscola). Temporary disturbances to soil would occur along proposed utility corridors. BMPs would prevent any additional adverse impacts. **Operations:** • No unavoidable adverse impacts would occur to physiography and soils. BMPs would be used to minimize impacts.	**Construction:** • Prime farmland soils (Mattoon and Tuscola) could be stockpiled and hauled off site during construction for other agricultural uses. **Operations:** • No mitigation measures warranted.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Groundwater	**Construction/Operations:** • No unavoidable adverse impacts would occur to groundwater resources. BMPs would be used to minimize impacts. • Some groundwater use would occur in Tuscola, Jewett, and Odessa. Impacts of water use are likely to be more important for the Odessa site.	**Construction/Operations:** • No mitigation measures warranted.
Surface Water	**Construction/Operations:** • No unavoidable adverse impacts would occur to surface water resources. BMPs would be used to minimize impacts. • Some surface water use would occur ***at*** Tuscola.	**Construction/Operations:** • No mitigation measures warranted.
Wetlands and Floodplains	**Construction:** • Construction of the proposed facility could result in unavoidable temporary impacts to wetlands along utility corridors. BMPs should prevent any adverse impacts from construction and operation of the FutureGen Project. **Operations:** • No unavoidable adverse impacts would occur to wetlands or floodplains. BMPs would be used to minimize impacts.	**Construction:** • Site design could avoid impacts to wetlands. New utility corridors could be located to avoid some wetlands. • Section 404 permits would be obtained for jurisdictional water-body and wetland alternations. As a permit condition, mitigation of wetland impacts would be in the form of direct replacement or other approved U.S. Army Corps of Engineers (USACE) and state mitigation requirements. Typical mitigation ratios for unavoidable impacts to wetlands would be 1:1 for open water and emergent wetlands, 1.5:1 for shrub wetlands, and up to 2:1 for forested wetlands. • Directional drilling of utilities in areas where mitigation is not required by the USACE would further reduce impacts to wetland resources. **Operations:** • No mitigation measures warranted.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Biological Resources	**Construction:** • Permanent unavoidable land disturbance at the proposed power plant site would result in permanent habitat loss of up to 200 acres (81 hectares). Temporary disturbances to additional aquatic and terrestrial habitats would occur along proposed utility corridors. BMPs should prevent any adverse impacts to these terrestrial and aquatic habitats. • No known occurrences of threatened and endangered species; however, the potential exists for an adverse impact to threatened or endangered species within each of the proposed FutureGen Project sites. Surveys for these species before construction would determine if they occur in the area. BMPs and coordination with state and federal agencies should prevent any adverse impacts. **Operations:** • No unavoidable adverse impacts would occur to biological resources. BMPs would be used to minimize impacts.	**Construction:** • Mitigation for federal endangered species, if necessary, would be defined during consultation with the U.S. Fish and Wildlife Service and could include passive measures such as construction timing outside of critical breeding periods, or more aggressive measures such as complete avoidance of impacts. **Operations:** • No mitigation measures warranted.
Cultural Resources	**Construction:** • Although there are no known areas of cultural significance, the potential exists for an adverse impact to cultural resources (Jewett and Odessa CO_2 corridors, Tuscola electrical transmission corridor). Archaeological surveys would determine location of any cultural resources and the possible extent of impact. Construction of the proposed facility is not anticipated to have any unavoidable adverse impacts relevant to cultural resources. • Consultation with Native American tribes was initiated; no tribes have requested involvement, however, coordination is ongoing. The potential of unavoidable adverse impacts would be resolved once consultation is complete. **Operations:** • No unavoidable adverse impacts would occur to cultural resources. BMPs would be used to minimize impacts.	**Construction:** • Consultation with the State Historic Preservation Officer (SHPO) for any new unforeseen areas of construction or ground disturbance not included within the EIS would be completed before construction to determine the need for cultural resource investigations and any appropriate mitigation measures. • Required management and mitigation measures regarding traditional cultural properties are unknown until consultation with Native American tribes is complete. **Operations:** • No mitigation measures warranted.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Land Use	**Construction:** • Direct unavoidable impact due to displacement of oil and gas wells (Odessa and Jewett). • Direct impact to any residential property and prime farmland (Mattoon and Tuscola) located adjacent to the power plant site; introduces industrial construction adjacent to residential property. BMPs used for aesthetics, noise, and traffic should minimize any adverse impacts on adjacent land use resulting from project construction. **Operations:** • No unavoidable adverse impacts would occur to land use. BMPs would be used to minimize impacts.	**Construction:** • Displaced oil and gas wells could be relocated. **Operations:** • No mitigation measures warranted. • FutureGen Project land that is not used for project purposes could be leased for agricultural use.
Aesthetics	**Construction/Operations:** • The proposed power plant (Mattoon and Tuscola) would cause a major unavoidable visual intrusion to residences within a 1-mile (1.6-kilometer) radius of the site. • Moderate unavoidable visual intrusion would occur for two residences near the Odessa site due to the presence of other industrial facilities that are visible in the general area and the FutureGen facility.	**Construction/Operations:** Potential mitigation measures that would reduce the aesthetic impacts of the facility include: • Enclosing some of the more "industrial" components of the plant in buildings. • Providing landscaping around the perimeter of the plant site to partially screen the plant from nearby residences and those passing by on the adjacent roads. • Selecting single-pole transmission towers to reduce the visual profile of the transmission towers. • Lighting design (e.g., luminaries with controlled candela distributions, well-shielded or hooded lighting, and directional lighting) could minimize potential for light pollution.
Transportation and Traffic	**Construction:** • Construction would create temporary localized adverse impacts due to the presence of additional trucks. BMPs should minimize additional impacts. • Temporary unavoidable impacts would occur to rail operations during construction of a new underpass (Odessa). **Operations:** • Changes to traffic signal timings may be required at ramp intersections to accommodate changes in the turning volumes.	**Construction:** • Truck traffic impacts would be mitigated through the use of signed truck routes to the proposed power plant site. Continued use of these routes during operations would reduce adverse impact. • At a minimum, trained rail construction flaggers would be required at all times during construction to accommodate traffic flow (Odessa). **Operations:** • No mitigation measures warranted.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Noise and Vibration	**<u>Construction</u>:** • Construction would result in unavoidable temporary elevated noise impacts at the power plant site, increasing ambient noise levels at nearby receptors. BMPs would reduce impacts. **<u>Operations</u>:** • Operational traffic activities within the power plant site would result in unavoidable noise increases at nearby residences (Mattoon and Tuscola). BMPs would reduce impacts. • Noise and vibration from train rail car shakers could generate noise levels up to 118 dBA. • Numerous power plant components could generate increases in ambient noise levels and some could generate vibrations.	**<u>Construction</u>:** • Noise mitigation measures to limit the number of heavy trucks passing by residential receptors during construction would include diverting truck trips, scheduling more deliveries on rail, or purchasing the impacted property (Mattoon and Tuscola). **<u>Operations</u>:** • Sound enclosures***, barrier walls, earthen berms,*** or dampening devices could be used whenever possible. In addition, alternate site configurations could be considered in order to position noise-producing equipment away from the impacted receptors (Mattoon and Tuscola). • Design of coal handling equipment would be evaluated during final design to reduce noise impacts to adjacent receptors.
Utility Systems	**<u>Construction/Operations</u>:** • No unavoidable adverse impacts would occur to utility systems. BMPs would be used to minimize impacts.	**<u>Construction/Operations</u>:** • No mitigation measures warranted.
Materials and Waste Management	**<u>Construction/Operations</u>:** • No unavoidable adverse impacts would occur to materials and waste management. BMPs would be used to minimize impacts.	**<u>Construction/Operations</u>:** • No mitigation measures warranted.
Human Health, Safety, and Accidents	• **<u>Construction/Operations</u>:** • Unavoidable adverse impacts to human health and safety, although unlikely, could result from various types of accidents, sabotage and terrorism acts, ranging from small pipeline leaks to, in the worst case, a power plant explosion. Two separate risk studies were completed to identify and evaluate the risks of most importance. The results of the risk assessments would help planners and designers to reduce these risks during the planning, designing, construction, and operation of FutureGen. • The potential for large spills of ammonia with adverse impacts to human health would be low.	**<u>Construction/Operations</u>:** • ***Design the power plant to provide: safe egress from all confined areas; adequate ventilation; fire protection; pressure relief to safe locations; and a real-time monitoring for hazardous chemicals with an alarm system. Institute safety training and evacuation policies to address accidents.*** • Design the CO_2 pipeline with automatic emergency shut-off valves spaced at 5-mile (8.0-kilometer) intervals to reduce the quantity of gases that could be released in the event of a pipeline rupture. The affected area associated with a release event would be reduced approximately linearly with the reduction in the distance between the shut-off valves. Automatic shut-off valves could be placed at 3-mile (4.8-kilometer) or 1-mile (1.6-kilometer) intervals near populated areas to further reduce the quantity of gases that could be released from a pipeline rupture or puncture. • Thicker pipe walls or armored pipe guards could be used at water

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
		body and road crossings. • The Risk Assessment associated with the preparation of the EIS delineated potential areas affected by pipeline ruptures and punctures. Set-back areas could be specified for populated areas. Pipelines could also be routed to maximize the distance to populated areas and sensitive receptors. • Well head and pipeline protective barriers could be installed (e.g., chain-link fences and posts or barricades). • The pipeline would be buried to minimize accidental damage. Deeper burial of the pipeline (deeper than 3 feet [0.9 meters]) in areas with higher population densities could reduce the risk of damage caused by digging and trenching. • Bleed valves could be added to control location and direction of releases should a puncture occur. The valves may be able to be designed to maximize the production of dry ice, snow, which reduces the peak concentrations of pipeline gases. • The use of in-line inspection vehicles or intelligence pigs can detect very early evidence of corrosion. Increased monitoring for corrosion and frequent inspections and clean-outs could be implemented in populated areas, in addition to the Supervisory Control and Data Acquisition monitoring of pipeline pressure, temperature, and flow rate. • The quantity of ammonia stored on site could be decreased from a 30-day supply to a 2-week supply using two smaller tanks. • The transfers from the tanker truck to the pipeline leading to the tank could be conducted within a portable secondary containment system. • Inspection would be conducted of the tanker truck and connecting pipe valves.
Community Services	**Construction/Operations:** • No unavoidable adverse impacts would occur to community services. BMPs would be used to minimize impacts.	**Construction/Operations:** • No mitigation measures warranted.

Table S-16. Possible Mitigation Measures for the FutureGen Project

Resource Area	Unavoidable Adverse Impacts	Possible Mitigation Measures
Socioeconomics	**Construction:** • Construction of the proposed facility would have unavoidable adverse impacts on residential properties located within, and adjacent to, the proposed power plant site property boundaries (Mattoon and Tuscola). BMPs should prevent any additional adverse impacts from construction and operations of the FutureGen Project. **Operations:** • Operation of the facility would have unavoidable adverse impacts on residents located very near the proposed power plant (Mattoon and Tuscola) through a potential unobstructed view of the facility, noise, and perhaps some dust or vibrations. The potential socioeconomic impact could be a reduction in property values for some homes very near or adjacent to the power plant.	**Construction:** • Purchase of the residences (two at Mattoon; three at Tuscola) would mitigate financial loss or other long-term impacts to residents from construction and operation of the FutureGen Project. **Operations:** • See mitigation measures under aesthetics and noise.
Environmental Justice	**Construction/Operations:** • Construction and operation of the proposed facility are not anticipated to have any unavoidable adverse impacts related to environmental justice.	**Construction/Operations:** • No mitigation measures warranted.

S.12 COMMITMENTS, USES, AND PRODUCTIVITY

S.12.1 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A resource commitment is **irreversible** when primary or secondary impacts from its use limit future use options and is **irretrievable** when its use or consumption is neither renewable nor recoverable for use by future generations.

This section describes the amounts and types of resources that would be irreversibly and irretrievably committed for the proposed FutureGen Project. A resource commitment is considered *irreversible* when primary or secondary impacts from its use limit future use options. Irreversible commitment applies primarily to nonrenewable resources such as minerals or cultural resources, and to those resources that are renewable only over long time spans, such as soil productivity. A resource commitment is considered *irretrievable* when the use or consumption of the resource is neither renewable nor recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or natural resources.

The principal resources that would be committed are the lands required for the construction of the proposed FutureGen Project, the proposed utility and transportation corridors requiring new construction and other utility ROWs, and the target formation for permanent CO_2 sequestration. Considerable amounts of water used to operate the FutureGen Power Plant would also be lost (i.e., evaporated rather than discharged back to surface or groundwater). Other resources that would be committed to the proposed project include construction materials (e.g., steel and concrete) and energy (e.g., coal and natural gas) used for construction and operation.

The amount of land that would be committed during construction of the proposed project would include land used for the power plant construction, rail loop, possible on-site landfill, storage piles, pipeline and power line construction ROWs, CO_2 injection site equipment and wells, and, to a lesser extent, access road construction. Although not all of the acreage at the power plant site would actually be developed, it is possible that the entire site would be off limits to other uses. For the Illinois sites, the use of land for the proposed power plant and injection infrastructure would preclude farming in the developed areas, although it is possible that, after the project is concluded, some of the land could revert back to agricultural use.

Temporary easements would be required during pipeline and power line construction, and permanent easements would be maintained for the pipeline ROWs. Temporary and permanent easement lands would not ordinarily be considered as irretrievable resources.

Injection of CO_2 into the subsurface would require gaining permanent mineral rights to the affected area at a defined depth interval. Because sequestration of the CO_2 is intended to be permanent, the use of this portion of the subsurface would be irreversibly committed to CO_2 storage. Once CO_2 injection is completed, some wells and equipment at the injection site could still be used for long-term monitoring purposes, but when the surface facilities are removed, the land could return to other uses.

The FutureGen Project would use up to 3,000 gallons (11,356 liters) of water per minute or 1.6 billion gallons (5.9 billion liters) of water annually that would be irretrievably committed. This water would be used primarily as process water in the cooling towers, which would convert the water to the vapor phase. Because the project would not discharge any of the water directly back to groundwater or surface water, much of this water may be lost to the local area and downstream users.

Material and energy resources committed for the FutureGen Project would include construction materials (e.g., steel, concrete), electricity, and fuel (e.g., coal, diesel, gasoline). All energy used during construction and operation would be irretrievable. During operation, the FutureGen Project would use up to 1.9 million tons (1.7 MMT) of coal annually. The coal source would vary, based on test plans during the 4-year research and testing phase of the project, and afterward could be based on the site location and market forces. Regardless of the source of the coal, these resources would be irretrievably committed. Based on 2005 U.S. coal production statistics, the FutureGen Project would use only 0.17 percent of the coal produced annually. The power plant would also use natural gas during startup and unplanned restart events. Although the amount of natural gas used would be negligible in relation to local capacity, it would be irretrievably committed.

The construction and operation of the proposed FutureGen Project would require the obligation of human resources that would not be available for other activities during the commitment period, but this requirement would not be irreversible.

Finally, the construction and operation of the FutureGen Project would require the commitment of fiscal resources by the Alliance and DOE. However, DOE believes these commitments would help to solve the environmental constraints of using fossil energy resources and to fulfill a Presidential Initiative and national need.

S.12.2 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The proposed power plant site would occupy up to 200 acres (81 hectares) and the injection site would occupy up to 10 acres (4 hectares) of land. Easements would be required for pipelines and power lines. The power plant would consume resources, including coal; natural gas; water; and small quantities of process chemicals, paints, degreasers, and lubricants. Slag from the gasification process would be used beneficially to the extent possible or would be properly disposed of at an off-site landfill if no beneficial use can be identified. Sulfur byproducts would be recovered and marketed. The long-term benefit of the proposed project would be to test advanced power generation systems using IGCC technology at a sufficiently large scale to allow industries and utilities to assess the project's potential for commercial application. The proposed project would also achieve low air emissions of GHGs by capturing and permanently sequestering CO_2 in a deep saline aquifer. This technology would foster the overall long-term reduction in the rate of CO_2 emissions from coal-fueled power plants.

The ability to successfully research and test advanced coal gasification on a variety of coal types, hydrogen turbines, or fuel cells, as well as carbon capture and sequestration, at an operating facility would provide incentive for energy providers in the U.S. and abroad to pursue these types of technologies for future power plants. The successful demonstration of near-zero-emissions electricity production from coal, an abundant worldwide energy source, could foster similar power plants. These technological advancements would further the goal of reducing anthropogenic emissions of GHG that lead to global warming. If the FutureGen Project is successful, the short-term use of land, materials, water, energy, and labor to construct and operate the project would have long-term positive impacts on reducing GHG emissions both in the U.S. and abroad.

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SUMMARY GLOSSARY

Term	Definition
Ambient Noise	Background noise associated with a given environment. Ambient noise is typically formed as a composite of sounds from many near and far sources, with no particular dominant sound.
Aquifer	Body of rock or sediment that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs.
Best Management Practice	Method for preventing or reducing the pollution resulting from an activity. Best management practice (BMP) includes non-regulatory methods designed to minimize harm to the environment.
Blowdown	Minimum discharge of recirculating water to discharge materials contained in the water, the further buildup of which would cause concentration in amounts exceeding limits established by best engineering practice.
Carbon Dioxide	Greenhouse gas created by combustion and emitted primarily from human activity such as the burning of fossil fuels to generate electricity and operate vehicles, abbreviated CO_2.
Class II Truck Route	Roadway that allows 80,000-pound (36,000-kilogram) vehicles up to 60 feet (17 meters) long with a width of 8.5 feet (2.6 meters).
Combined Cycle	Combination of two or more thermodynamic cycles in a chemical process, usually for power generation.
Cultural Resources	Archaeological sites, historical sites (e.g., standing structures), Native-American resources, and paleontological resources.
Decibel	Unit used to convey intensity of sound, abbreviated (dB).
Deep Ocean Sequestration	Deliberate injection of captured CO_2 into the ocean at great depths where it could potentially be isolated from the atmosphere for centuries. While the technologies currently exist to directly inject CO_2 into the deep ocean, the knowledge base is inadequate to determine what biological, physical, or chemical impacts might occur from interactions with the marine ecosystem.
Deep Saline Aquifer	Deep underground rock formation composed of permeable materials and containing highly saline fluids.
Density	Ratio of a substance's weight relative to its volume.
Dissolution	Process of dissolving a substance into a liquid.
Effluent	Waste stream flowing into the atmosphere, surface water, groundwater, or soil.

Term	Definition
Endangered Species	Plants or animals that are in danger of extinction. A federal list of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). Illinois maintains its list of endangered species with the Illinois Endangered Species Protection Board and Texas maintains its list with the Texas Parks and Wildlife Department.
Floodplain	Flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding.
Fuel Cell	Electrochemical cell in which the energy of a reaction between a fuel, such as liquid hydrogen, and an oxidant, such as liquid oxygen, is converted directly and continuously into electrical energy.
Gasification	Conversion process to gas or a gas-like phase.
Geologic Sequestration	CO_2 capture and storage in deep underground geologic formations.
Greenhouse Gas	Gas that contributes to the greenhouse effect by absorbing infrared radiation and ultimately warming the atmosphere. Greenhouse gases include water vapor, nitrous oxide (NO_X), methane, CO_2, ozone (O_3), halogenated fluorocarbons, hydrofluorocarbons, and perfluorinated carbons.
Hazardous Waste	Waste that exhibits at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or that is specifically listed by the U.S. Environmental Protection Agency as a hazardous waste. Hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA) Subtitle C.
Heat Rate	Amount of heat required (usually in Btu) to produce an amount of electricity (usually in kW-hr).
Induced Job	Job created or sustained when wage incomes of those employed in direct and indirect jobs are spent on the purchase of goods and services in a region.
Integration	Organization or structure so that constituent units function cooperatively.
Level of Service	Measure of traffic operation effectiveness on a particular roadway facility type.
Low-Income Population	A community that has a proportion of low-income population greater than the respective average. Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from Bureau of the Census Current Population Reports, Series P-60, Income and Poverty.
Megawatt	Unit of power equal to one million watts. A power plant with 1 megawatt (MW) of capacity operating continuously for a year could supply electricity to approximately 750 households.

Term	Definition
Mineral Sequestration	Process of CO_2 reacting with metal oxide bearing materials to form insoluble stable carbonates. Mineral sequestration's main economic challenge is the extremely slow reaction process of naturally occurring minerals with CO_2.
Minority	Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
Minority Population	Identified where either the affected area's minority population exceeds 50 percent or the affected area's minority population percentage is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
Monitoring, Mitigation, and Verification	Capability to measure the amount of CO_2 stored at a sequestration site, monitor the site for leaks, to verify that the CO_2 is stored in a way that is permanent and not harmful to the host ecosystem, and to respond to CO_2 leakage or ecological damage in the unlikely event that it should occur. Monitoring, mitigation, and verification (MM&V) applies to geologic sequestration and terrestrial sequestration.
National Energy Policy	The National Energy Policy (NEP), developed by the National Energy Policy Development Group in 2001 with members of the President's cabinet, is based on three principles: provide a long-term, comprehensive energy strategy; advance new, environmentally-friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use; and seek to raise the living standards of the American people, recognizing that to do so our country must fully integrate its energy, environmental, and economic policies.
National Environmental Policy Act	Signed into law on January 1, 1970, the National Environmental Policy Act (NEPA) of 1969, declared a national policy to protect the environment and created the Council on Environmental Quality (CEQ) in the Executive Office of the President. To implement the national policy, NEPA requires that environmental factors be considered when federal agencies make decisions, and that a detailed statement of environmental impacts be prepared for all major federal actions significantly affecting the human environment.
National Pollutant Discharge Elimination System	Provision of the Clean Water Act that prohibits discharge of pollutants into U.S. waters unless a special permit is issued by EPA, a state, or where delegated, a tribal government on a Native American reservation, abbreviated NPDES.
Permeability	Rate at which fluids flow through the subsurface and reflects the degree to which pore space is connected.
pH	A measure of the acidity or alkalinity of a solution.
Plume Radius	Radius within which 95 percent of the sequestered gas-phase CO_2 mass occurs.

Term	Definition
Saline Formation	Porous rock formation that is overlain by one or more impermeable rock formations and thus has the potential to trap injected CO_2.
Supercritical CO_2	CO_2 usually behaves as a gas in air or as a solid in dry ice. If the temperature and pressure are both increased (above its supercritical temperature of 88ºF [31.1ºC] and 73 Atmosphere [1073 psi]), it can adopt properties midway between a gas and a liquid, such that it expands to fill its container like a gas, but has a density like that of a liquid.
Surface Water	All bodies of water on the surface and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, and estuaries.
Syngas	Gas mixture containing varying amounts of CO and H_2 generated by the gasification of a carbon-containing fuel.
Terrestrial Sequestration	Process through which CO_2 from the atmosphere is absorbed by trees, plants, and crops through photosynthesis and stored as carbon compounds in biomass (tree trunks, branches, foliage, and roots) and soils. While terrestrial sequestration may be an attractive and useful sequestration option, the long-term accountability and permanence, and the inability to directly store the CO_2 captured from a particular power plant make this option unlikely to be implemented in the electrical power industry.
Threatened Species	Plants or animals likely to become endangered species within the foreseeable future. A federal list of threatened species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 227.4 (marine organisms). Illinois maintains its list of threatened species with the Illinois Endangered Species Protection Board and Texas maintains its list with the Texas Parks and Wildlife Department.
Traditional Cultural Property	District, site, building, structure, or object that is valued by a community for the role it plays in sustaining the community's cultural integrity.
Unplanned Restart	A series of events where power plant components are re-activated in a sequence to bring the plant to its fully operating state after an upset condition has been remedied.
Upset Condition	An unpredictable failure of process components or subsystems which leads to an overall malfunction or temporary shutdown of the power plant.
Vibration	Force that oscillates about a specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm), and strokes per minute (spm).

Term	Definition
Wetland	Area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
Zero Liquid Discharge System	Process separates solids and dissolved constituents from the plant wastewater and allows the treated water to be recycled or reused in the industrial process, resulting in no discharge of wastewater to the environment.

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SUMMARY INDEX

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