COVER SHEET

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

Title: Mountaineer Commercial Scale Carbon Capture and Storage Project, Draft Environmental Impact Statement (DOE/EIS-0445D)

Location: New Haven, West Virginia, located in Mason County

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Abstract:

This Draft Environmental Impact Statement (EIS) provides information about the potential environmental impacts of the proposed Mountaineer Commercial Scale Carbon Capture and Storage (CCS) Project (Mountaineer CCS II Project) to be located in Mason County, West Virginia near the town of New Haven. American Electric Power Service Corporation (AEP) proposes to design, construct, and operate the Mountaineer CCS II Project, which would use a chilled ammonia process (CAP) technology to capture approximately 90 percent of the carbon dioxide (CO_2) from a 235-megawatt (MW) portion of AEP's existing 1,300-MW Mountaineer Plant flue gas exhaust.

The Mountaineer CCS II Project would be designed to capture 1.5 million metric tons of CO_2 per year from the plant exhaust that the facility would otherwise emit. The captured CO_2 would be compressed and conveyed via pipeline to nearby injection wells for storage in geologic formations located approximately 1.5 miles below the land surface.

DOE's Proposed Action would provide financial assistance to AEP under the Clean Coal Power Initiative (CCPI) Program to support construction and operation of AEP's Mountaineer CCS II Project. DOE proposes to provide AEP with up to $334 million of the overall project cost, which would constitute about 50 percent of the estimated total development cost, 50 percent of the capital cost of the project and 50 percent of the operational cost, during the 46-month demonstration period. This EIS also analyzes the No Action Alternative, under which DOE would not provide financial assistance for the Mountaineer CCS II Project.

Comment Period:

DOE encourages public participation in the NEPA process. Comments postmarked by April 18, 2011, will be addressed in the Final EIS, which will be used by DOE in its decision-making process for the Proposed Action. DOE will consider late comments to the extent practicable.

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ACRONYMS

Acronym	Definition
acfm	actual cubic feet per minute
ACGIH	American Conference of Governmental Industrial Hygienists
ADT	average daily traffic
AEP	American Electric Power Service Corporation
AIHA	American Industrial Hygiene Association
amsl	above mean sea level
APE	Area of Potential Effect
AST	aboveground storage tank
bgs	below ground surface
BMP	best management practice
C-8	perfluorooctanoatic acid
C&D	construction and demolition
CAA	Clean Air Act
CAP	chilled ammonia process
CCPI	Clean Coal Power Initiative
CCS	carbon capture and storage
CCTP	Climate Change Technology Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-eq	carbon dioxide equivalent
CSR	Code of State Rules
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
DEGADIS	Dense Gas Dispersion Model

Acronym	Definition
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DWWM	Division of Water and Waste Management
EHS Policy	Environmental, Health, and Safety Policy
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPAct05	Energy Policy Act of 2005
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FGD	flue gas desulfurization
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FOA	funding opportunity announcement
FPPA	Farmland Protection Policy Act
FR	Federal Register
GHG	greenhouse gas
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
GPS	Global Positioning System
HAP	hazardous air pollutant
HEL	highly erodible land
HTS	Huntington Tri-State
HUD	U.S. Department of Housing and Urban Development
HVTL	high voltage transmission line
hydrotest	hydrostatic pressure testing

Acronym	Definition
IPCC	Intergovernmental Panel on Climate Change
L_{90}	sound level that is exceeded 90 percent of the time
L_{eq}	continuous equivalent sound level
L_{dn}	day-night average sound level
lbs/hr	pounds per hour
LOS	level of service
LWD	lost work day
MBTA	Migratory Bird Treaty Act
mD	millidarcy
mgd	million gallons per day
mg/l	milligrams per liter
MMBtu	million British thermal units
Mountaineer CCS II Project	Mountaineer Commercial Scale Carbon Capture and Storage Project
MRCSP	Midwest Regional Carbon Sequestration Partnership
MW	megawatt
MVA	monitoring, verification, and accounting
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standard
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NH_3	ammonia
NHPA	National Historic Preservation Act
NHSWF	New Haven Sanitary Waste Facility
NHWF	New Haven Water Facility
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOA	Notice of Availability
NOI	Notice of Intent

Acronym	Definition
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSR	New Source Review
NWI	National Wetland Inventory
O_3	ozone
OSHA	Occupational Safety and Health Administration
Pb	lead
PCE	passenger car equivalent
PEL	permissible exposure limit
PHEL	potentially highly erodible land
PM	particulate matter
$PM_{2.5}$	particulate matter of diameter 2.5 microns or less
PM_{10}	particulate matter of diameter 10 microns or less
ppm	parts per million
ppmv	parts per million by volume
PSD	Prevention of Significant Deterioration
psi	pound per square inch
PSMS	Process Safety Management Standard
PVF	product validation facility
RMP	Risk Management Plan
ROD	Record of Decision
ROI	region of influence
ROW	right-of-way
SCBA	self-contained breathing apparatus
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_3	sulfur trioxide

Acronym	Definition
SO_x	sulfur oxides
SPCC	Spill Prevention, Control, and Countermeasures
SPL	sound pressure level
STEL	Short Term Exposure Limit
STP	shovel test pit
SWPPP	Stormwater Pollution Prevention Plan
TDS	total dissolved solids
TLV	threshold limit value
TMDL	total maximum daily load
tpy	tons per year
TRC	total recordable case
UIC	Underground Injection Control
UIUC	University of Illinois Urbana-Champaign
U.S.	United States
USACE	U.S. Army Corps of Engineers
USBLS	U.S. Bureau of Labor Statistics
USC	United States Code
USDA	U.S. Department of Agriculture
USDW	underground source of drinking water
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V/C	volume-to-capacity
VOC	volatile organic compound
WVAAQS	West Virginia Ambient Air Quality Standard
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources
WVDOT	West Virginia Department of Transportation
WVSHPO	West Virginia State Historic Preservation Office
WWTP	wastewater treatment plant

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GLOSSARY

Term	Definition
"A-weighted" Scale	Assigns weight to sound frequencies that are related to how sensitive the human ear is to each sound frequency. Frequencies that are less sensitive to the human ear are weighted less than those for which the ear is more sensitive. A-weighted measurements indicate the potential damage a noise might cause to hearing.
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.
Amines	A group of organic compounds of nitrogen, typically derived from ammonia, with one or more of the hydrogen atoms in ammonia replaced by one or more organic functional groups. Amines include amino acids and a wide range of primary, secondary, and tertiary amines used for dyes, pharmaceuticals, and gas treatment.
Ammonia Slip	Unused ammonia in the downstream flue gas following post-combustion processes that use ammonia or urea as reagents to remove pollutants.
Aquifer	Rock or sediment formation(s) saturated and sufficiently permeable to transmit groundwater and yielding economic quantities of water to wells or springs.
Arterial Road	Road generally characterized by its ability to quickly move a relatively large volume of traffic, but often with restricted capacities to serve abutting properties. Arterial system typically provide for high travel volume.
Atmospheric Stability	Resistance of the atmosphere to vertical motion. Atmospheric stability may be affected by temperature changes, wind speed, surface characteristics, and other factors. The Pasquill atmospheric stability classes categorize the atmospheric turbulence into six stability classes named A, B, C, D, E, and F with class A being the most unstable or most turbulent class and class F representing calm, stable conditions.
Attenuate	To lessen the amount of force, magnitude, or value of something.
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.
Carbon Dioxide	A common chemical compound, abbreviated CO_2, composed of two oxygen atoms covalently bonded to a single carbon atom. This natural greenhouse gas is also created by combustion and emitted from human activity such as the burning of fossil fuels to generate electricity and operate vehicles.

Term	Definition
Clean Water Act	Primary federal law governing water pollution. The Clean Water Act's (CWA's) goals include eliminating toxic substance releases to water, eliminating additional water pollution, and ensuring that surface waters meet standards necessary to support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." (see National Pollutant Discharge Elimination System).
Continuous Equivalent Sound Level	Steady-state decibel level which would produce the same A-weighted sound energy over a stated period of time as an equivalent sound over time.
Cultural Resources	Archaeological sites, historical sites (e.g., standing structures), Native-American resources, and paleontological resources.
Day-night Average Sound Level	A-weighted equivalent decibel level for a 24-hour period with an additional 10-dB weighting imposed on the equivalent sound levels occurring during nighttime hours (10 pm to 7 am).
Decibel	Unit used to convey intensity of sound, abbreviated (dB).
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.
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).
Floodplain	Flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding.
Geologic Sequestration	Process of injecting CO_2, captured from an industrial or energy-related source into deep subsurface rock formations for long-term storage.
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 (EPA) as a hazardous waste. Hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA) Subtitle C.

Term	Definition
Historic Property	Prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places.
Indirect Job	Job created or sustained from a project's purchase of goods and services from businesses in a region.
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.
Level of Service	Measure of traffic operation effectiveness on a particular roadway facility type, abbreviated LOS.
Local Roads	Public roads and streets not classified as arterials or collectors. Local roads and streets are characterized by the many points of direct access to adjacent properties and the relatively minor value in accommodating mobility. Speeds and volumes are usually low and trip distances short.
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 the Bureau of the Census Current Population Reports, Series P-60, Income and Poverty.
Mean Sea Level	Average ocean surface height at a particular location for all stages of the tide over a specified time interval (generally 19 years).
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.
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.
National Environmental Policy Act	Signed into law on January 1, 1970, the National Environmental Policy Act (NEPA) 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.

Term	Definition
National Oceanic Atmospheric and Administration	Department of Commerce agency focused on the condition of the oceans and atmosphere. NOAA divisions include the National Weather Service, the National Hurricane Center, and the National Marine Fisheries Service.
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; 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.
Potable Water	Water that is safe and satisfactory for drinking and cooking.
Saline Formation	Underground rock or sediment layer(s) which contains water with more than 10,000 ppm total dissolved solids (unsuitable for drinking water and often too deep to be economically pumped).
Slipstream	The portion or percentage of the flue gas exhaust that is diverted to another location for monitoring, research, or separate testing.
Solubility	Ability or tendency of one substance to dissolve into another at a given temperature and pressure.
Sound Pressure Level	Measure of a sound’s strength or intensity, expressed in dB. The sound pressure level generated by a steady source of sound will usually vary with distance and direction from the source.
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 [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.
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).
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, abbreviated TCP.

Term	Definition
Underground Source of Drinking Water	Any aquifer or part of an aquifer that (1) supplies any public water system; or (2) contains a sufficient quantity of groundwater to supply a public water system, and currently supplies drinking water for human consumption or contains fewer than 10,000 milligrams per liter of total dissolved solids; and (3) is not an exempted aquifer.
Upset	An unplanned start when the entire system is held at no load while an issue with a component is corrected.
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).
Viscosity	Measure of a material's resistance to flow.
Wetland	Area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
Wind Rose	Circular diagram that illustrates the relative frequency of wind speeds for each compass direction based on a time interval.

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SUMMARY

The United States (U.S.) Department of Energy (DOE) prepared this Environmental Impact Statement (EIS) to evaluate the potential impacts associated with its Proposed Action to provide financial assistance to American Electric Power Service Corporation (AEP) under the Clean Coal Power Initiative (CCPI). DOE's Proposed Action would support construction and operation of AEP's Mountaineer Commercial Scale Carbon Capture and Storage (CCS) Project (Mountaineer CCS II Project). Congress established the CCPI Program to enable and accelerate the deployment of advanced technologies to ensure clean, reliable, and affordable electricity for the U.S. The CCPI operates a cost-shared partnership between government and industry to develop and demonstrate advanced coal-based power generation technology at the commercial scale. DOE selected the AEP Mountaineer CCS II Project for possible funding because it would best meet the CCPI's goals and objectives.

The Mountaineer CCS II Project would use a chilled ammonia process (CAP) to capture approximately 90 percent of the carbon dioxide (CO_2) from a 235-megawatt (MW) portion of AEP's existing 1,300-MW Mountaineer Plant flue gas exhaust. The project would be designed to capture 1.5 million metric tons of CO_2 per year from plant operations that the facility would otherwise emit. The captured CO_2 would be compressed and conveyed via pipeline to injection wells for geologic storage in deep saline formations, approximately 1.5 miles below the land surface.

The existing Mountaineer Plant, shown in Figure S-1, is located on a 450-acre property in Mason County, West Virginia along the Ohio River. Other AEP facilities located on the property include the Phillip Sporn Power Plant and the Little Broad Run Landfill, both of which are owned and operated by AEP. Figure S-1 also shows the potential CO_2 pipeline corridors and CO_2 injection well properties. New Haven, West Virginia is located approximately 1 mile to the northwest (i.e., down-river). The plant is in an industrial area and located next to relatively undeveloped lands with scattered residences and mining operations to the south and west.

DOE is the lead federal agency responsible for preparation of this EIS. Pursuant to the National Environmental Policy Act (NEPA) and in compliance with the Council on Environmental Quality (CEQ) implementing regulations for NEPA (40 Code of Federal Regulations [CFR] 1500 through 1508) and DOE NEPA procedures (10 CFR 1021), DOE is evaluating the associated environmental impacts as part of its decision-making process to determine whether to provide AEP with financial assistance for its proposed project.

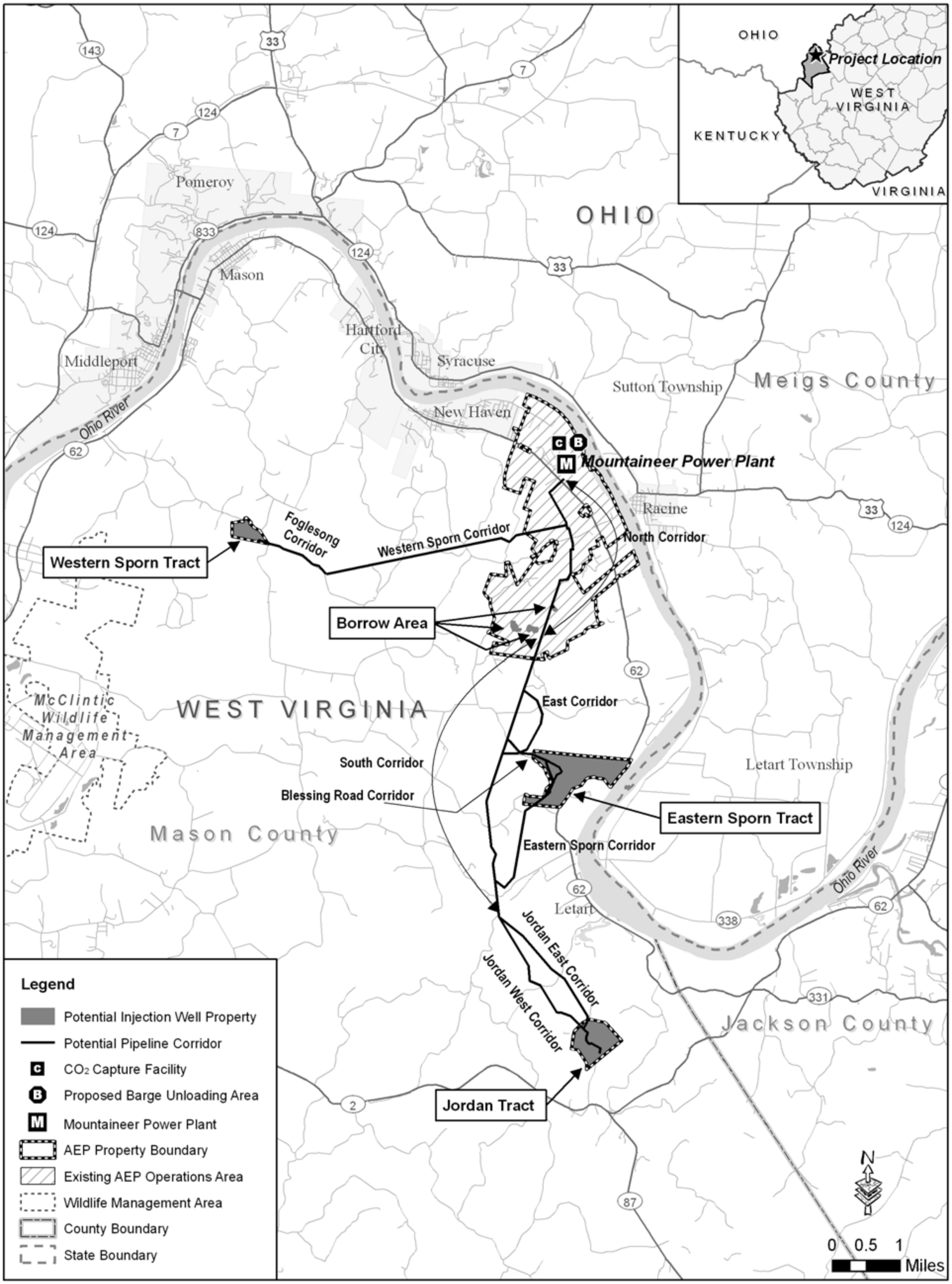

Figure S-1. General Area Map

PROPOSED AGENCY ACTION, PURPOSE AND NEED

DOE's Proposed Action would provide financial assistance to AEP under the CCPI Program to support construction and operation of AEP's Mountaineer CCS II Project. Congress established the CCPI Program to enable and accelerate the deployment of advanced technologies to ensure clean, reliable, and affordable electricity for the U.S. The CCPI operates as a cost-shared partnership between government and industry to develop and demonstrate advanced coal-based power generation technologies at the commercial scale. DOE selects projects for CCPI funding through funding opportunity announcements (FOA) that solicit project proponents to submit applications for federal cost-sharing for their demonstration projects. To date, the CCPI Program has conducted three rounds of solicitations for projects to achieve its goals.

AEP submitted an application for its proposed Mountaineer CCS II Project in response to the CCPI Round 3 solicitation. Round 3, which DOE conducted in two phases, sought projects that would demonstrate advanced coal-based electricity generating technologies that capture and sequester (or put to beneficial use) CO_2 emissions.[1] DOE selected the AEP Mountaineer CCS II Project and four other applications for possible funding pending further, more detailed consideration. DOE determined that these five projects would best meet the CCPI's goals and objectives.

AEP proposes to construct a commercial-scale CCS system at its 1,300 MW Mountaineer Power Plant and other AEP-owned properties located near New Haven, West Virginia. DOE proposes to provide AEP with up to $334 million of the overall project cost. This funding would constitute about 50 percent of the estimated total project cost.

As part of the Mountaineer CCS II Project, AEP would construct a CO_2 capture facility using Alstom's CAP at the Mountaineer Plant. Alstom's CAP is a proprietary process for removing CO_2 from combustion flue gas emissions. The capture facility would process a slipstream of approximately 18 percent of the total Mountaineer Plant's flue gas flow, equivalent in quantity to the flue gas emissions from a 235-MW power plant. Each year, approximately 1.5 million metric tons of CO_2 would be captured, treated, and compressed into a highly concentrated, high-pressure form suitable for geologic storage. The processed CO_2 would be transported by pipeline (primarily underground) to injection wells to be developed on AEP properties. These properties are located within approximately 12 miles of the Mountaineer Plant in Mason County, West Virginia. The captured CO_2 would be injected into deep saline formations for permanent geologic storage.

Consistent with DOE's objectives under CCPI Round 3, the Mountaineer CCS II Project would be designed to:

- Remove approximately 90 percent of the CO_2 from the 235-MW slipstream;
- Demonstrate a commercial-scale deployment of the CAP for CO_2 capture; and
- Demonstrate the injection, permanent geologic storage, and monitoring of CO_2 in deep underground saline formations.

The *purpose* of DOE's Proposed Action under the CCPI Program is to demonstrate advanced coal-based technologies at a commercial scale that capture and geologically sequester CO_2 emissions. The principal *need* addressed by DOE's Proposed Action is to satisfy the responsibility Congress imposed on DOE to

[1] As stated in the Financial Assistance FOA for Round 3, "DOE's specific objective is to demonstrate advanced coal-based technologies that capture and sequester, or put to beneficial use, CO_2 emissions. DOE's goals are to demonstrate at commercial scale in a commercial setting, technologies that (1) can achieve a minimum of 50 percent CO_2 capture efficiency and make progress toward a target CO_2 capture efficiency of approximately 90 percent in a gas stream containing at least 10 percent CO_2 by volume, (2) make progress toward capture and sequestration goal of less than 10 percent increase in the cost of electricity for gasification systems and less than 35 percent for combustion and oxycombustion systems all as compared to current (2008) practice, and (3) capture and sequester or put to beneficial use a minimum of 300,000 tons per year of CO_2 emissions using a 30-day running average to determine if the project successfully meets the CO_2 capture efficiency and the capture and sequestration or beneficial use rate requirements of this Announcement" (NETL, 2009).

demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The CCPI Program selects projects with the best chance of achieving the program's objective as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial service.

This proposed project would help DOE, through the CCPI Program, meet its congressionally mandated mission to fund advanced clean-coal technology projects. This specifically includes those projects that have progressed beyond the research and development stage to a point of readiness for operation at a scale that, once demonstrated, can be readily implemented across the commercial sector. Post-combustion CO_2 capture offers the greatest near-term potential for reducing power sector CO_2 emissions because it can be used to retrofit existing coal-based power plants and can also be tuned for various levels of CO_2 capture, which may accelerate market acceptance (NETL, 2010a). A successful demonstration of Alstom's CAP at the Mountaineer Plant would generate technical, environmental, and financial data from the design, construction, and operation of the facility. These data would help DOE and the electric power industry determine whether the deployed technologies can be effectively and economically implemented at a commercial scale. Furthermore, the cost-shared financial assistance from DOE would reduce the risk to AEP in demonstrating this technology.

ALTERNATIVES CONSIDERED BY DOE

Section 102 of NEPA requires that agencies discuss the reasonable alternatives to the Proposed Action in an EIS. The term "reasonable alternatives" is not self defining, but rather must be determined in the context of the statutory purpose expressed by the underlying legislation. The purpose and need for a federal action determines the reasonable alternatives for the NEPA process. Any reasonable alternative to the Proposed Action must be capable of satisfying the purpose and need of the CCPI Program.

Options considered by DOE for possible CCPI funding originate as private-party (e.g., electric power industry) applications submitted to DOE in response to requirements specified in CCPI solicitations. DOE is limited to considering the application as proposed by the applicant. For example, DOE cannot consider site or technology combinations other than those included in the applications received. The applicant provides at least a 50-50 cost share and bears the primary responsibility for designing and executing the project. DOE's primary action concerning these applications is to decide which projects would receive DOE financial assistance from among the eligible applications submitted. Unlike a project initiated and operated by DOE, DOE does not have the ability to make decisions concerning the location, layout, design, or other features of the project. In other words, DOE must select from among the eligible projects submitted to DOE by the applicants; DOE cannot design its own project and compel a private entity to implement it.

DOE's decision is to either accept or reject the project as proposed by the proponent, including its proposed technology and selected sites. DOE's Proposed Action is limited to providing financial assistance in a cost-sharing arrangement to AEP's proposed Mountaineer CCS II Project, which was selected from among the projects that were submitted by applicants in response to a competitive funding opportunity. Consequently, DOE's consideration of reasonable alternatives is also limited to the technically acceptable applications and the No-Action Alternative for each selected project.

No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the proposed Mountaineer CCS II Project. In this case, the funding withheld from the Mountaineer CCS II Project may be made available for other current or future CCPI projects. In the absence of DOE cost-shared funding, AEP could still elect to construct and operate the proposed project; therefore, the DOE No Action Alternative could result in one of two potential scenarios:

- The proposed Mountaineer CCS II Project would not be built; or
- The proposed Mountaineer CCS II Project would be built by AEP without benefit of DOE cost-shared funding.

DOE assumes that if AEP proceeded with project development in the absence of DOE cost-shared funding, the project would include the features, attributes, and impacts as described for the Proposed Action. However, without DOE participation, it is possible that the project would be canceled. Therefore, for the purposes of analysis in this EIS, the DOE No Action Alternative is defined as a No-Build Alternative. This means that the project would not be built and environmental conditions would remain in the status quo (i.e., no new construction, resource utilization, or CO_2 capture and storage would occur).

Therefore, under the No Action Alternative, the project technologies (i.e., large-scale CO_2 capture and geologic storage) may not be implemented in the near term. Consequently, timely commercialization of these technologies for large-scale, coal-fired electric generation facilities would be postponed and may not be realized. This scenario would not contribute to the CCPI goals to invest in the demonstration of advanced coal-based power generation technologies that capture and sequester, or put to beneficial use, CO_2 emissions. While the No Action Alternative would not satisfy the purpose and need for the agency action, this alternative was retained to provide a comparative baseline against which to analyze the effects of the Proposed Action, as required under CEQ regulations (40 CFR 15012.14). The No Action Alternative reflects the status quo and serves as a benchmark against which the effects of the Proposed Action can be evaluated.

Alternative Project Applications Considered During the CCPI Procurement Process

DOE's options for CCPI - Round 3 funding consist of the other technically acceptable applications received in response to FOA DE-FOA-0000042, *Clean Coal Power Initiative - Round 3, Amendments 005 and 006*. DOE received 36 applications that met the minimum eligibility requirements listed in the FOA for Round 3 of the CCPI. These applications provided DOE with a range of options for meeting the objectives of Round 3 of the CCPI. DOE screened the 36 applications to evaluate potential environmental consequences of each application during DOE's initial review and made preliminary determinations regarding the level of NEPA review required. In accordance with DOE NEPA regulations (10 CFR 1021.216), DOE documented the potential environmental consequences of each application in an environmental critique and summarized the results in a publicly available synopsis. DOE considered this environmental information in the selection process.

Ultimately, DOE determined that the proposed Mountaineer CCS II Project and four other applications would best meet the goals and objectives of the CCPI Program. The proposed projects from these five applications must each complete a separate, independent, project-specific (and more detailed) NEPA analysis that would result in separate decisions. Although the five selected projects are each eligible for cost-shared funding under CCPI, there is no other relationship among them. Each of the projects is independent, and the selection and potential execution of each stand-alone project has no effect or bearing on the other projects.

Project Options Considered by the Project Proponent

AEP responded to DOE's solicitation with its application for the proposed project, which is based on a commercial scale-up of AEP's existing CAP product validation facility (PVF), constructed at the Mountaineer Plant in 2009. The PVF captures CO_2 from a 20-MW flue gas slipstream and injects the captured CO_2 into two deep geologic formations via two wells located on the Mountaineer Plant property. This PVF uses a similar process, albeit smaller in size, to the proposed project. The proposed project is designed to demonstrate the commercial-scale operation of an integrated CCS project using Alstom's CAP process.

Because Alstom's CAP technology may result in lower energy losses compared to other methods of post-combustion CO_2 capture, AEP did not consider other CO_2 capture technologies as part of their proposed project. However, AEP plans to complete a study to evaluate the feasibility of an amine-based CO_2 capture technology. AEP entered into a cooperative agreement with China Huaneng, through which AEP, China Huaneng, DOE, and the National Energy Administration of China will perform an initial evaluation of a post-combustion, advanced amine-based CO_2 capture technology. AEP will complete a study to evaluate the feasibility of the technology for potential use at supercritical coal-fired generating units with characteristics similar to the Mountaineer Plant. The feasibility study would evaluate technical issues related to design, performance, cost, and process integration. In addition, it would consider lessons learned from the testing and deployment of this technology by others for possible application to the Mountaineer CCS Project. Results of the study may provide insight on key design and operating considerations, which could be used to evaluate development opportunities and associated risks in context with other potential CO_2 capture processes.

AEP determined the five closest properties to be the most feasible for possible injection well sites, which would also minimize potential environmental impacts. AEP eliminated the remaining properties from further consideration as these properties were located much farther from the Mountaineer Plant and presented significant challenges in securing right-of-way (ROW) agreements and regulatory approvals in a timely manner. Likewise, the greater distance would add significant cost and time to the overall project, as well as create a greater potential for environmental impacts associated with additional stream, river, and wetland crossings.

EIS SCOPING PROCESS

DOE published a Notice of Intent (NOI) to prepare an EIS in the *Federal Register* on June 7, 2010 (Federal Register Doc. 2010-13568). The NOI initially identified potential issues and areas of impact that would be addressed in the EIS. DOE published notices in local newspapers announcing the public scoping meeting location and time. DOE held a public scoping meeting on June 22, 2010 at the New Haven Elementary School in New Haven, West Virginia. This meeting was attended by seven members of the public, as well as project staff from DOE, AEP, and its other project partners.

The public scoping period ended on July 9, 2010 after a 30-day comment period. DOE received two scoping comments at the public scoping meeting. One commenter spoke at the public scoping meeting during the formal comment period. Although this commenter did not have a specific comment about the scope of the project, he spoke about the history of the AEP Mountaineer Power Plant, development and deployment of air emission control technologies, and his hope that the Mountaineer CCS II Project would be successful. One local landowner spoke with a DOE representative at the public scoping meeting, but did not wish to comment during the formal comment period or submit a comment in writing. This individual owns property adjacent to the northern boundary of AEP's property. Although the property is connected to city water, there was concern about potential impacts to drinking water wells as a result of CO_2 leaks. (Potential impacts to drinking water wells are addressed in the Groundwater section of this EIS.) DOE received no other comments during the 30-day scoping period.

Although most of the resource areas initially identified by DOE received little or no attention from the public during the scoping period, the EIS nevertheless addresses potential impacts to all resource areas identified during both internal planning and public scoping for the proposed project.

DESCRIPTION OF APPLICANT'S PROPOSED PROJECT

AEP's proposed project is designed to demonstrate the operation of an integrated CCS process at commercial scale on a coal-fired power plant. There are four primary components of the project (see Figure S-2 and Table S-1):

1. **CO_2 Capture Facility** – The facility would capture CO_2 from a 235-MW flue gas slipstream from the existing 1,300-MW coal-powered Mountaineer Plant. The facility would be designed with a target CO_2 capture rate of approximately 90 percent and built on plant property.
2. **CO_2 Pipelines** – The captured CO_2 would be transported by pipeline (primarily underground) to AEP-owned properties located within 12 miles of the Mountaineer Plant.
3. **CO_2 Injection Wells** – The captured CO_2 would be injected into geologic formations located approximately 1.5 miles below the ground surface through injection wells located on two or more AEP-owned properties.
4. **CO_2 Monitoring, Verification, and Accounting (MVA)** – A geologic monitoring program would be established and operated in accordance with the required Underground Injection Control (UIC) permit.

The CO_2 capture system proposed for the Mountaineer CCS II Project would be similar to the Alstom CAP PVF currently operating at the Mountaineer Plant, but approximately 12 times larger. As with the PVF, the process would use an ammonia-based process solution to capture CO_2 and isolate it in a form suitable for geologic storage. The existing Mountaineer Plant includes the space and infrastructure required to support the construction and operation of the CO_2 capture system.

Major new equipment required would include absorbers, regenerators, pumps, heat exchangers, and refrigeration equipment. In addition, the project would require an administration building, a control room/electrical switchgear building, warehouse and maintenance facilities, water-handling equipment, and laboratories, as well as other buildings and components under consideration, such as a compressor building, a by-product/bleed stream treatment building, an industrial wastewater treatment plant (WWTP), auxiliary power transformer bays, and power distribution buildings. Table S-2 summarizes some of the key requirements and characteristics of the project.

The project would transport captured CO_2 via pipeline to injection wells located within 12 miles of the Mountaineer Plant. The ultimate configuration of the pipeline routes would depend on which potential injection well sites would be used. Lands between the Mountaineer Plant and some of the injection well properties are not entirely owned by AEP; therefore, AEP would establish a pipeline corridor and obtain legal ROWs, setbacks, and easements as needed. AEP identified potential pipeline corridors, divided into segments to facilitate alternative routing options, from the Mountaineer Plant to the potential injection well properties (see Figure S-2).

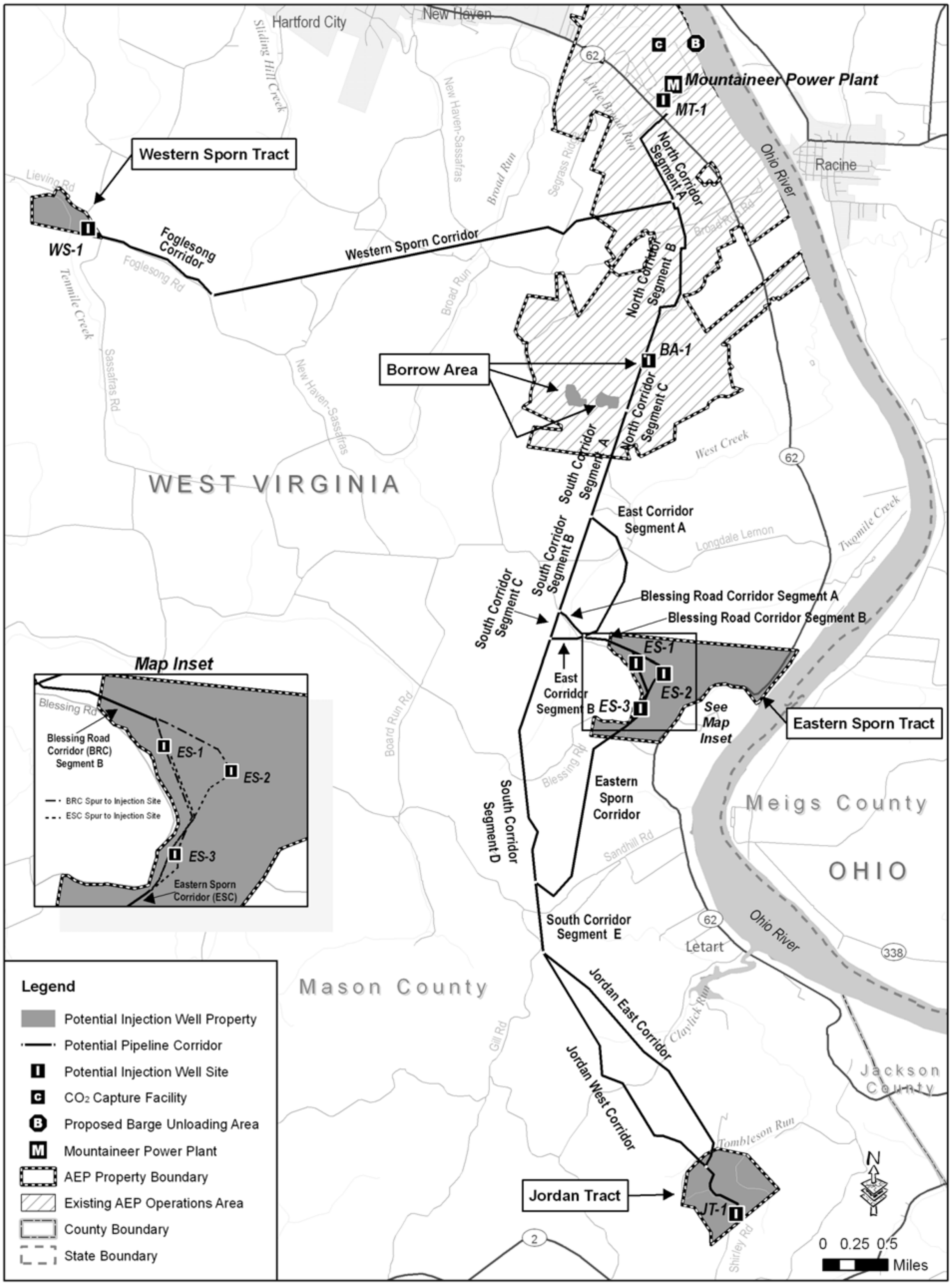

Figure S-2. Potential Project Features

Table S-1. Mountaineer CCS II Project Features

Feature	Description	Characteristics
CO_2 Capture Facility	**Location:** A capture facility would be constructed at the Mountaineer Plant. The facility would use Alstom's CAP technology to capture CO_2 from a 235-MW flue gas slipstream from the plant's 1,300-MW pulverized coal-fired electric generating unit. **CO_2 Capture Capacity:** 1.5 million metric tons of CO_2 per year	**Facility Footprint:** 500 x 1000 feet (11.5 acres), located within a 33-acre area at the Mountaineer Plant.
CO_2 Pipelines	**Routes:** Pipelines used to transport CO_2 to the injection wells would be co-located within existing road and HVTL ROWs, to the extent possible. The length of the pipeline routes vary by corridor option. The range of pipeline lengths to the following injection well properties is: (1) Mountaineer Plant (0.13 mile); (2) Borrow Area (2.24 miles); (3) Eastern Sporn Tract (5.00 to 8.65 miles); (4) Jordan Tract (9.24 to 9.68 miles); and (5) Western Sporn Tract (5.69 miles). **Operator:** AEP would own, operate, and maintain the CO_2 pipelines.	**Construction ROW Width:** 80-120 feet **Permanent ROW Width:** 50 feet
CO_2 Injection Well Properties	**Locations:** AEP anticipates that the project would require four to eight wells, located in pairs, at two to four of the following five properties: (1) Mountaineer Plant (33 acres); (2) Borrow Area (28 acres); (3) Eastern Sporn Tract (400 acres); (4) Jordan Tract (195 acres); and (5) Western Sporn Tract (70 acres). **Quantity:** Each well would be designed to inject approximately 0.5 million metric tons of CO_2 per year. The total injection rate would be 1.5 million metric tpy. **Access Roads:** Access roads would be constructed from public roads to the injection well sites.	**Construction Area:** Approximately 5 acres per injection well site **Well Depth:** Approximately 7,500 to 8,500 feet bgs **Operational Area:** 0.5 acre per site **Access Roads:** **Construction Width:** 25-30 feet **Permanent Width:** 12-15 feet
Monitoring Wells	**Locations:** The final approved UIC permit would dictate the final number of and siting requirements for monitoring wells. Characterization wells could be converted to monitoring wells in the future. For this analysis, it is estimated that AEP would construct and use one to three monitoring wells per injection well, and that the monitoring wells would be placed within approximately 1,500 to 3,000 feet of the injection wells.	**Construction Area:** Approximately 5 acres per well site **Well Depth:** Dependent upon UIC permit requirements **Operational Area:** 0.5 acre per site (may be co-located at injection well sites)

bgs = below ground surface; CO_2 = carbon dioxide; HVTL = high voltage transmission line; MW = megawatt; ROW = right-of-way; tpy = tons per year; UIC = Underground Injection Control

AEP's pipelines would follow existing, previously disturbed AEP electrical transmission line ROWs to the extent possible. The pipelines would be constructed of carbon steel and range from approximately 8 to 12 inches in nominal diameter. The pipelines would operate at a pressure of up to 3,000 pounds per square inch (psi). All pipelines would be installed below ground, except for locations where the pipeline would cross a vertical rock outcropping. The only pipeline features that would potentially be visible along the route would be: (1) minimal locations where the pipeline crosses a vertical rock outcropping; (2) pipeline location markers (primarily positioned at road and stream crossings, fence lines, or where the pipeline is above ground surface); and (3) cathodic protection test posts located on each side of all road crossings.

AEP is considering five AEP-owned properties for the location of the CO_2 injection wells (listed in descending order of preference): Mountaineer Plant, Borrow Area, Jordan Tract, Eastern Sporn Tract, and Western Sporn Tract. AEP anticipates that the project would require four to eight injection wells, located in pairs, at two to four different properties. Final design of the number and location of injection wells for the project would be determined based on results of an ongoing geologic characterization study. AEP has selected possible locations for the injection well sites on each injection property, as shown in Figure S-2: Mountaineer Plant Injection Well Site MT-1, Borrow Area Injection Well Site BA-1, Jordan Tract Injection Well Site JT-1, Eastern Sporn Tract Injection Well Sites ES-1, ES-2, and ES-3, and Western Sporn Tract Injection Well Site WS-1. Injection wells would be approximately 7,500 to 8,500 feet deep. Once injected, the CO_2 would be trapped underground by a confinement system, which includes impermeable layers of rock known as "caprock." Caprock consists of thick (hundreds or thousands of feet) layers of non-porous rock that act as caps or seals to trap the injected fluid. The CO_2 injected into these formations might extend to an estimated radius of 3 miles from each injection well site.

AEP selected the preferred locations of proposed project features, including access roads, pipelines, and injection well sites, with consideration of each location's suitability for construction and operation, and based on AEP's siting criteria. AEP would use these same siting criteria in the event that a project feature would need to be relocated, and when choosing locations for the required monitoring wells. To the extent practical, these siting criteria include the following:

- **Avoid wetlands** – Project features would avoid wetland areas.
- **Avoid streams and floodplains** – Project features would avoid streams and floodplains and minimize the number of pipeline stream crossings.
- **Avoid sensitive habitats** – Project features would avoid areas identified as sensitive habitats.
- **Avoid cultural resources** – Project features would avoid areas containing known cultural resources.
- **Proximity to public roads** – Project features would use areas with ready access to public roads to minimize the creation of new access roads.
- **Topography** – Project features would use areas that are generally flat to minimize grading requirements and erosion potential.

Table S-2. Project Requirements and Characteristics Summary

Requirement/ Characteristic	Description	Source/Provider
Potable Water	**Quantity:** During peak construction potable water usage could range from 1,500 to 45,600 gpd; during operations, up to 2,200 gpd.	**Utility Provider:** New Haven Water Facility
Process Water	**Quantity:** Construction is expected to use a total of approximately 2.5 million gallons and an additional 600,000 gallons of demineralized water for hydrotesting and system startup. Operations usage rate would be approximately 1.9 mgd.	**Source:** Mountaineer Plant's existing river water loop.
Electricity Required during Operations	**Power:** 50 – 80 MW	**Utility Provider:** Existing Mountaineer Plant
Sanitary Wastewater	**Receiving Point:** Sanitary wastewater from construction would be handled through either public utility or portable restrooms. **Quantity:** During construction, sanitary wastewater could range from 1,500 gpd to 48,000 gpd; during operations, up to 2,300 gpd.	**Utility Provider:** New Haven Sanitary Waste Facility
Industrial Wastewater	**Receiving Point:** If the WWTP is unable to handle the additional load of the project, a new industrial WWTP would be constructed. Effluent from the new WWTP would be sent to the existing plant's permitted outfall. **Quantity:** Wastewater from the flue gas cooling and cleaning process; quantity varies. Absorber building sump wastewater; quantity varies. Off-spec ammonium sulfate solution (15-35 percent by weight) would be generated by the CAP process. If the market warrants, AEP would provide an onsite treatment system to evaporate water from the solution to produce a concentrated dry ammonium sulfate product. If it can't be sold as by-product (fertilizer), it would be treated and disposed of at the AEP landfill.	**Utility Provider:** General industrial wastewater treated or reused by the Mountaineer Plant
Non-hazardous Solid Waste Generation	**Receiving Point:** There are three regional solid waste disposal facilities: Charleston Municipal Landfill (13 years remaining), Disposal Services Landfill (37 years remaining), or Allied Waste Sycamore Landfill (37 years remaining). **Quantity:** During construction, a total of 10,720 cubic yards of general garbage and construction and demolition debris. During operation, approximately 10 cubic yards per month.	**Utility Provider:** Local municipal landfills.
Dry Ammonium Sulfate By-Product Generation	**Receiving Point:** Regional agricultural interests or, should a market not be available for sale of the material, the AEP Little Broad Run landfill. **Quantity:** During operation quantity would vary (maximum 30 tons per day).	**Process:** Ammonium sulfate solution treated onsite to evaporate water to produce concentrated dry by-product.

Table S-2. Project Requirements and Characteristics Summary

<table>
<tr><th>Requirement/ Characteristic</th><th>Description</th><th>Source/Provider</th></tr>
<tr><td>Materials and Wastes Transport</td><td>Deliveries or waste shipments include reagent (aqueous and/or anhydrous ammonia), sulfuric acid, ammonium sulfate by-product, waste streams, and other miscellaneous construction equipment and service vehicles.
Material Shipment Quantity:
<table>
<tr><th>Chemical</th><th>Truck Shipments (per year)</th><th>Rail-car Shipments (per year)</th></tr>
<tr><td>Anhydrous ammonia</td><td>180</td><td>40</td></tr>
<tr><td>Aqueous ammonia</td><td>430</td><td>100</td></tr>
<tr><td>Sulfuric acid</td><td>120</td><td>40</td></tr>
<tr><td colspan="3">Wastes or By-Product Shipment Quantity:</td></tr>
<tr><td>Ammonium sulfate</td><td>730</td><td>NA</td></tr>
</table>
Construction truck deliveries – 20 to 90 per month.
Operations truck trips – up to 14 per day (includes general waste streams and service vehicles).</td><td>Provider:
Commercial Carriers</td></tr>
<tr><td>CAP Chemical Inputs</td><td><u>Reagent Option 1</u>: 100-percent anhydrous ammonia (28,739 gallons stored).
<u>Reagent Option 2</u>: 29-percent aqueous ammonia (54,308 gallons stored) and 100-percent anhydrous ammonia for system startup or upset conditions (28,739 gallons stored).
<u>Refrigerant</u>: Anhydrous ammonia (157,000 gallons stored).
<u>Other Process Chemicals</u>: Sulfuric acid (45,000 gallons stored); ammonium sulfate 15-35 percent by weight (150,000 gallons stored).</td><td>Source:
Commercial Markets</td></tr>
<tr><td>Flue Gas Inlet and Outlet Constituents</td><td>
<table>
<tr><th>Flue Gas Constituent</th><th>Nominal CAP Inlet</th><th>Estimated CAP Outlet</th></tr>
<tr><td>CO_2 (ppmv)</td><td>105,993</td><td>13,000</td></tr>
<tr><td>N_2 (ppmv)</td><td>680,900</td><td>813,000</td></tr>
<tr><td>NH_3 (ppmv)</td><td>2.0</td><td><10</td></tr>
<tr><td>NO_x (ppmv)</td><td>100</td><td><100</td></tr>
<tr><td>O_2 (ppmv)</td><td>54,900</td><td>67,000</td></tr>
<tr><td>PM (lbs/hour)</td><td>125</td><td><50</td></tr>
<tr><td>SO_2 (ppmv)</td><td>80</td><td><20</td></tr>
<tr><td>SO_3 (ppmv)</td><td>25</td><td><10</td></tr>
</table></td><td></td></tr>
</table>

CAP = chilled ammonia process; CO_2 = carbon dioxide; gpd = gallons per day; HVTL = high voltage transmission line; lbs = pounds; mgd = million gallons per day; MW = megawatt; N_2 = nitrogen; NH_3 = ammonia; NO_x = nitrogen oxides; O_2 = oxygen; PM = particulate matter; ppmv = part per million by volume; SO_2 = sulfur dioxide; SO_3 = sulfur trioxide; WWTP = wastewater treatment plant

Construction of the proposed project would likely start in January 2013 and take approximately 32 months to complete. This 32-month period includes approximately 8 months of commissioning prior to commencing commercial operations. The number of construction workers would vary during the construction period, ranging from 25 to 800 persons during the various phases of construction. During construction of the CO_2 capture facility, AEP would receive the delivery of materials via truck and via barge traffic by two methods. The first method would use an existing barge unloading platform to remove material from moored barges via a mobile crane. The second method represents an upgrade to the existing unloading capabilities and would allow for larger equipment to be unloaded through the use of a temporary mobile bridge that would span the area between the river bank and the parked barge.

The project demonstration phase would last 3 years and 10 months (46 months total) per the terms and conditions of the Cooperative Agreement between DOE and AEP. AEP would determine whether to continue operating the CCS facility after the demonstration is complete. A variety of factors could affect the possible long-term operation of the CCS facility, including potential future CO_2 legislation and regulations, process performance, and economics. For the purposes of this EIS, DOE assumed the CCS facility would continue to operate for 20 years.

The existing Mountaineer Plant currently employs 195 people. The project would require an increase of approximately 38 full-time employees divided among 4 shifts (i.e., an increase of approximately 19 percent over current conditions).

During the operational life of the Mountaineer CCS II Project, AEP would monitor the CO_2 injection process and storage integrity through the use of monitoring wells and any other methods required by the UIC permit. Monitoring can be divided into three primary types, including: (1) injection system monitoring; (2) confinement monitoring; and (3) CO_2 tracking in the injection zone. Thus, monitoring wells of varying depths would be an integral part of the MVA program. However, the final UIC permit would determine the minimum overall monitoring parameters for the proposed CO_2 storage system.

POTENTIAL OPERATING SCENARIOS

The specific manner in which AEP would ultimately implement the project depends on a combination of factors. These factors include, but are not limited to, the results of the geologic characterization study, pipeline routing constraints, UIC permitting conditions, and various cost factors. To assess the potential range of impacts that could occur from implementation of the project, several scenarios for proposed project implementation have been considered in this EIS. Section 4.1 of the EIS, Comparative Impacts of Alternatives, presents three scenarios (A, B, and C); however, this summary presents only the upper and the lower bound scenarios (A and C) (see Table S-3 for description of all three scenarios). These scenarios present combinations of pipeline corridors and injection well properties that are representative of a reasonable range of options that could be implemented. These are not intended to provide an exhaustive list of options, but rather to bracket the range of available options and illustrate reasonable and plausible combinations.

DOE evaluated each of the scenarios listed in Table S-3 in this EIS in order to assess the range of potential impacts that could occur and to properly bind the impact analyses. Assuming geologic characteristics are favorable at all locations, Scenario A would be AEP's preferred scenario and Scenario C would be AEP's least preferred scenario. This preference is based largely on cost, effort to implement, and environmental considerations. Scenario A would minimize these elements; Scenario C would maximize them. As such, Scenario C is the least preferable and considered to be the upper bound or "worst case" from an impact perspective because it would involve the greatest length of pipelines, the greatest number of required injection wells, and the greatest number of properties involved with the project. The number of injection wells on any one site would be based on the final design and could require more than two wells.

Table S-3. Proposed Project Implementation Scenarios

Injection Well Property	Alternative Route	Scenario A "Lower Bound"	Scenario B	Scenario C "Upper Bound"
		Number of Injection Wells per Property		
Mountaineer Plant (MT-1 Location)	Plant Routing	2	0	0
Borrow Area	Borrow Area Route	2	2	2
Eastern Sporn Tract	Eastern Sporn Route 1	0	2	2
	Eastern Sporn Route 2			
	Eastern Sporn Route 3			
	Eastern Sporn Route 4			
Jordan Tract	Jordan Route 1	0	2	2
	Jordan Route 2			
	Jordan Route 3			
	Jordan Route 4			
Western Sporn Tract	Western Sporn Route	0	0	2

Note: These scenarios present combinations of pipeline routes and injection well properties that are representative of a reasonable range of options that could be implemented. Scenario A represents the lower bound (least wells and shortest pipeline) for impacts related to the number of wells and length of pipeline, while Scenario C represents an upper bound (most wells and longest pipeline). These are not intended to provide an exhaustive list of options, but rather to bracket the range of available options and illustrate reasonable and plausible combinations.

CHARACTERISTICS OF THE AFFECTED ENVIRONMENT

The affected environment, also referred to as the region of influence (ROI), for the project was defined for each of 18 environmental resource areas depending on the extent of potential impacts resulting from plant and infrastructure construction and operation. The size of the ROI varies by resource depending upon the extent of potential impacts on respective resources. In general, the EIS considered the environmental setting in Mason County and portions of neighboring counties in West Virginia and Ohio as appropriate per resource area. Table S-4 summarizes the affected environment for each of the 18 resource areas. The affected environment for each of these resources is described in greater detail in Chapter 3 of the EIS.

Table S-4. Affected Environment of the Mountaineer CCS II Project

Resource	Existing Conditions
Air Quality and Climate	The location of the Mountaineer CCS II Project has been designated unclassifiable or in attainment of all National Ambient Air Quality Standards, except $PM_{2.5}$, (40 CFR 81.349). Mason County has been designated as partial nonattainment with the particulate matter (2.5 micron diameter) standard for the Graham Tax District area.
Greenhouse Gases	Emissions of CO_2 from fossil fuel combustion within the State of West Virginia totaled 116.4 million metric tons in 2007, with 85.5 million metric tons resulting from electric power generation. Currently, there are no West Virginia regulations pertaining to limits in emissions of GHGs.
Geology	Bedrock in the ROI consists of sedimentary rock sequences and alternating layers of shale, limestone, dolomite, and sandstone within the basin. An exploratory well drilled at the Mountaineer Plant found brine intervals at the Rose Run (sandstone) Formation at a depth of 7,706 to 7,822 feet bgs, and the Copper Ridge Formation at 8,150 to 8,400 feet bgs. These formations are included in the proposed injection zone. The injection zone is capped by

Table S-4. Affected Environment of the Mountaineer CCS II Project

Resource	Existing Conditions
	primary and secondary confining zones, which consist of dense and impermeable dolomite, thick shale, and limestone sequences in the bedrock column. Core tests determined that the permeability and porosity of formations in the injection zone can readily support CO_2 injection. Over 800 feet of dolomite and limestone and 1,300 feet of shale overlay the injection zone. A seismic study conducted by AEP did not identify any faults. The closest regional fault system, the Rome Trough, is approximately 25 miles to the southeast of the Mountaineer Plant. Since 1973, there have been four recorded earthquakes within a 30-mile radius of the Mountaineer Plant, all of which were at or below magnitude 3.5.
Physiography and Soils	The study area lies completely within the Central Allegheny Plateau Major Land Resource Area, a physiographic section of the larger Appalachian Plateau province. Elevations in the study area range from 500 feet above sea level along the Ohio River, to 1,260 feet at the top of Garnes Knob. The soils in the study area formed in residuum, colluvium, eolian, and alluvium materials. Prime farmland soils exist within the footprints of each of the potential pipeline corridors except the Eastern Sporn Corridor. The great majority of the soils are either mapped as HEL or PHEL throughout the study area.
Groundwater	There are three primary potable groundwater sources in the ROI: (1) the Ohio River Valley-fill aquifer, (2) Quaternary alluvium in stream valleys, and (3) sandstone units in the Pennsylvanian bedrock. The Ohio River Valley-fill aquifer is the most productive, with yields of up to 1,000 to 3,000 gpm. The Mason County Public Service District provides the majority of potable water for the county. Local drinking water is provided by the NHWF services approximately 650 households with a 150,000 gpd withdrawal from 2 wells in New Haven that are drilled to about 80 feet bgs into the Ohio River Valley-fill aquifer.
Surface Water	The project is located within the Ohio River Basin watershed. There are no surface water features within or immediately adjacent to the CO_2 capture facility; however, the Ohio River is located 1,000 feet to the east of the facility and Little Broad Run is located approximately 2,000 feet to the west of the facility. The land areas for each of the potential pipeline corridors and injection well properties include stream features, the majority of which are intermittent or ephemeral in nature.
Wetlands and Floodplains	There are no wetlands located within or adjacent to the land area proposed for the CO_2 capture facility and barge unloading area. There is a small (less than 0.1 acre) palustrine emergent wetland in the center of a depression to the southwest of the barge unloading area that accepts drainage from interior portions of the site and then discharges to the Ohio River. There are wetlands located within each of the potential pipeline corridors except for the Mountaineer Plant routing. There are wetlands located within each of the potential injection well properties except for the Mountaineer Plant. There are FEMA-mapped floodplains located at the CO_2 capture facility location; however, since the FEMA maps were published, the site has been elevated substantially for the development of the Mountaineer Plant to, in most cases, above the elevation of the base flood. The land area proposed for the upgrades to the existing barge unloading area would be located within the FEMA-mapped 100-year floodplain below the mapped base flood elevation. One of the potential pipeline corridors (i.e., the Western Sporn Corridor) would cross FEMA-mapped floodplains. The Eastern Sporn Tract and Western Sporn Tract potential injection well properties contain FEMA-mapped floodplains.
Biological Resources	The area for the proposed CO_2 capture facility includes approximately 33 acres of human altered land (grasses), which provides poor habitat quality for most wildlife species, with the exception of those species adapted to high levels of human activity and disturbance. The majority of the potential pipeline corridors consist of previously cleared HVTL ROW (classified as Ruderal Early Successional Grassland and Scrub/Shrub), which is maintained to control vegetation growth. The majority proportions of land cover types within the potential injection well properties include: Developed, Medium Density for the Mountaineer Plant and Borrow Area, and South-Central Interior Mesophytic Forest for the Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract. Mason County is near the edge of the range of the federally listed-endangered Indiana bat (*Myotis sodalis*). Mist net and habitat surveys for Indiana bats in the ROI were performed and no evidence of Indiana bats was found as a result of this study.

Table S-4. Affected Environment of the Mountaineer CCS II Project

Resource	Existing Conditions
	Three federally listed-endangered aquatic species (Pink mucket pearly mussel [*Lampsilis abrupt*], Fanshell mussel [*Cyprogenia stegaria irrorata*], and Clubshell [*Pleurobema clava*]) and two federal candidate aquatic species (Sheepnose mussel [*Plethobasus cyphyus*] and Diamond darter [*Crystallaria cincotta*]) have the potential to occur within the ROI; however, a survey conducted in 2005 in the Ohio River off shore from the Mountaineer Plant did not identify any protected species.
Cultural Resources	No NRHP-listed or NRHP-eligible archaeological resources occur within a 1-mile radius of the area proposed for the CO_2 capture facility, pipeline corridors, and potential injection sites. A Phase I archaeological survey was conducted of all proposed impact areas of the project. The field survey identified one previously unrecorded cemetery and one isolated artifact in the project area. The cemetery was considered to be potentially eligible for inclusion on the NRHP, while the artifact was not. WVSHPO concurred on these eligibility determinations. The WVSHPO determined that two historic resources within the APE of the Mountaineer Plant are eligible for listing in the NRHP and there are also two historic resources that are not eligible. No NRHP-listed or NRHP-eligible historic resources occur within a 1-mile radius of any of the pipeline corridors. An architectural survey to identify resources over 50 years of age identified 13 resources within the APE of the injection well properties. The WVSHPO concurred that two of these resources are NRHP-eligible and the others are not.
Land Use and Aesthetics	Although no zoning classifications have been identified for the area, land use can be characterized as industrial. Land use in the region includes rural privately-owned properties, mining areas, and other industrial facilities, while land cover in the region consists of natural land cover (i.e., forested, riparian/floodplain and wetland), developed land/disturbed open space, agricultural land, and previously disturbed cover. The entire CO_2 capture facility site is characterized by developed open space and industrial fields associated with the plant (i.e., grassy areas). Several of the pipeline corridors run entirely along existing HVTL easements; other pipeline corridors run largely along an existing easement but include one or more short deviations. Several of the corridors, however, cross private property and would require the establishment of new ROWs.
Traffic and Transportation	Featured transportation infrastructure within the ROI includes a 20-mile corridor of State Route 62, the CSX Transportation rail line, and a nearby barge unloading area on the Ohio River. State Route 62 provides direct access to the Mountaineer Plant and to the smaller connector roads that provide access to the pipelines and injection well sites. In the ROI, State Route 62 is a paved, two-lane highway. Traffic volumes in the ROI are typical of rural areas – generally, these roadways experience relatively low traffic volumes and minor roadway congestion. During normal operations, the 2007 average daily traffic on State Route 62 ranged from 1,200 to 6,000 vehicles. One public at-grade rail crossing is located within the ROI in New Haven at Midway Drive. According to the Federal Railroad Administration, this rail crossing experiences approximately eight train pass-bys per day.
Noise	Existing dominant noise sources in the vicinity of the CO_2 capture facility mainly consist of traffic on State Route 62, operations at the existing Mountaineer Plant, rail traffic on the CSX Transportation rail line, and material handling equipment associated with the barge deliveries on the Ohio River. Noise sources along the potential pipeline corridors and potential injection well sites primarily consist of vehicular traffic as the area is located near roadways within a predominately rural area.
Materials and Waste Management	Adequate suppliers exist for construction and operational materials. Adequate disposal capacity exists in West Virginia and Ohio for solid and hazardous wastes. In addition, there are adequate hazardous waste treatment, storage, disposal, and recycling facilities within the region both within West Virginia and bordering states.
Human Health and Safety	The ROI for potential releases from the CO_2 capture facility (5 miles from the facility) includes the towns of Hartford and New Haven, West Virginia, as well as Syracuse and Racine, Ohio. New Haven and Racine are the closest towns to the Mountaineer Power plant and have populations of 1,510 and 740, respectively. Predominant winds (36 percent of the time) are from the west and southwest and are not in the direction of these towns. Wind directions

Table S-4. Affected Environment of the Mountaineer CCS II Project

Resource	Existing Conditions
	toward New Haven and Racine, occur approximately 5.4 percent and 4.5 percent of the time, respectively. Winds toward Harford and Syracuse occur approximately 6.0 and 6.1 percent of the time, respectively.
Utilities	The Mountaineer Power Plant produces its own electrical energy for operations. The NHWF provides potable water to the plant. Process water is supplied from a river water loop via the Ohio River at a rate of approximately 18.74 mgd. Sanitary wastewater is piped to the NHSWF for treatment. Industrial wastewater is treated by an onsite wastewater treatment facility prior to discharge into the Ohio River, which generates 0.14 mgd of sludge, and is disposed of at AEP's Little Broad Run Landfill adjacent to the Mountaineer Plant. The potential pipeline corridors and injection well sites do not currently contain the infrastructure for water supply, wastewater treatment, or electrical power.
Community Services	The New Haven Volunteer Fire Department and the Mason Volunteer Fire Department serve the existing Mountaineer Plant. The West Virginia portion of the ROI is served by 20 fire stations and the Ohio ROI is served by 7 fire stations. The Mason County Office of Emergency Management serves as an umbrella organization covering several agencies including, Enhanced 911, Emergency Medical Services, Local Emergency Planning Committee and overall emergency management. The ROI is served by six hospitals.
Socioeconomics	Collectively, Mason County and the 5 adjacent counties (Cabell, Jackson, Putnam, Gallia, and Meigs) have a population of approximately 258,054, which increased by 0.5 percent since 2000. Among the 6 counties, Putnam County experienced the greatest population growth since 2000 (7.9 percent), while the state population increased by 0.6 percent. The population of Mason County is approximately 25,568, down 1.5 percent since 2000. The 6 counties include approximately 118,862 housing units of which approximately 9.1 percent are vacant rental units and another 1.0 percent are otherwise vacant. The median household income in the 6 counties is nearly $5,000 less annually than the state median. The recent unemployment rate within the ROI is higher than both the state average and the national rate.
Environmental Justice	The percentage of minorities among the Mason County population (1.8 percent) is substantially lower than both the state (5.5 percent) and national (20.2 percent) averages. The low income population distribution in Mason County (18.1 percent) is slightly higher than the state average (17.4 percent) and higher than the national average (13.2 percent).

APE = area of potential effects; bgs=below ground surface; CFR = Code of Federal Regulations; CO_2 = carbon dioxide; FEMA = Federal Emergency Management Agency; gpd = gallons per day; gpm = gallons per minute; GHG=greenhouse gas; HEL = highly erodible land; HVTL = high voltage transmission line; mgd = million gallons per day; NHSWF = New Haven Sanitary Waste Facility; NHWF = New Haven Water Facility; NRHP = National Register of Historic Places; PHEL = potentially highly erodible land; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; ROI = region of influence; ROW = right of way; WVSHPO = West Virginia State Historic Preservation Office

ENVIRONMENTAL IMPACTS

DOE evaluated the potential impacts of the Proposed Action and the No Action Alternative in relation to the baseline conditions described in Chapter 3 and summarized above. The most detailed discussion of potential impacts is provided in Chapter 3, and a detailed table summarizing the potential adverse impacts is included in Section 4.1, Comparative Impacts of Alternatives. Table S-5 summarizes the potential impacts for each of the 18 resource areas for the No Action Alternative and for both “Lower” and “Upper” Bounding Case Scenarios of the Proposed Action as outlined in Table S-3 previously.

The EIS uses the following descriptors to qualitatively characterize impacts on respective resources:

- ***Beneficial*** – Impacts would benefit the resource.
- ***Negligible*** – No apparent or measurable impacts are expected; may also be described as “none” if appropriate.
- ***Minor*** – The action would have a barely noticeable or measurable adverse impact on the resource.
- ***Moderate*** – The action would have a noticeable or measurable adverse impact on the resource. This category could include potentially significant impacts that would be reduced to a lesser degree by the implementation of mitigation measures.
- ***Substantial*** – The action would have obvious and extensive adverse effects that could result in potentially significant impacts on a resource despite mitigation measures.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
Air Quality and Climate		
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their current conditions; there would be no changes to air quality.	***Minor adverse impacts.*** Construction of the CO_2 capture facility, pipeline corridors, and injection well sites would result in short-term, localized increased tailpipe and fugitive dust emissions. The CAP facility would be designed solely for the capture of CO_2 emissions. However, based on the energy and mass balance flow rate for the project, the CAP would be expected to offer the co-benefit of reducing flue gas emissions, including SO_2, SO_3 and PM, although the amount of potential reduction is not known. For the purpose of evaluating potential impacts on air quality, DOE conservatively assumed that the stack emissions of criteria pollutants from the CAP would not change from existing stack emissions. AEP ammonia concentrations could increase by 48.7 tpy; however, no regulatory standards would be exceeded. It is expected that any potential impact from a change to plume behavior from the exhaust merge would be minimal or insignificant.	***Minor adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario, though slightly higher temporary tailpipe and fugitive dust emissions during construction due to longer pipeline corridors and four additional injection wells. Operation of the project would be similar to the Lower Bound Scenario.
Greenhouse Gases		
Loss of potential benefit. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their current conditions; there would be no changes to GHG emissions. However, without the project, there would be no reduction in	***Beneficial impacts.*** Construction of the CO_2 capture facility, pipeline corridors, and injection sites, could generate GHGs amounting to approximately 37,246 metric tons of CO_2-eq. Operation of the CO_2 capture facility would result in the capture and storage of approximately 1.5 million metric tons per year of CO_2-eq. It is estimated that the total CO_2 emissions from the Mountaineer Plant would be reduced by approximately 18 percent. The potential contribution of anthropogenic GHG emissions to climate change is inherently a global cumulative	***Beneficial impacts.*** Construction impacts would be similar to the Lower Bound Scenario, though slightly higher tailpipe GHG emissions during construction due to longer pipeline corridors and four additional injection wells, amounting to approximately 69,358 metric tons of CO_2-eq. Operation of the project would be similar to the Lower Bound Scenario.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
GHG emissions from the Mountaineer Plant and no demonstration of advanced coal-based power generation technologies that capture and sequester CO_2 emissions.	phenomenon, and direct impacts from this project cannot be determined with current scientific methods.	
	Geology	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their current conditions; there would be no changes to geologic resources.	***Minor adverse impacts.*** Construction of the pipeline may require some bedrock excavation. Construction of the injection well sites would result in removal of geologic media through the drilling process. This process would not be unique to the area and would not affect the availability of local geologic resources. Hydraulic stimulation would likely be required to increase injectivity; however, it is anticipated that this would not increase the potential for CO_2 vertical migration from the target formation. Operation of the CO_2 capture facility and pipeline corridors would not affect geologic resources. At the injection well sites, the potential of CO_2 migrating upward through fractures in the caprock seal is considered highly unlikely. AEP would conduct extensive studies and monitoring, in accordance with the UIC Permit, to minimize this potential long-term impact and have in place the appropriate mitigation strategies should such CO_2 migration be identified. Preliminary CO_2 plume analysis shows that the CO_2 may extend 2 miles from the Rose Run injection wells and 3 miles from the Copper Ridge wells. AEP would perform additional seismic surveys as part of the project's geologic characterization process to confirm that each site is adequately capped. Based on existing seismic surveys, it is expected that increased seismicity in the ROI due to CO_2 injection or hydraulic stimulation would be very unlikely.	***Minor adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario for the CO_2 capture facility; and similar for the pipeline corridors, though additional bedrock excavation may be required due to longer pipeline lengths. Construction of the injection wells would be similar to the Lower Bound Scenario, though additional geologic media would be removed due to development of four additional wells. Operation of the project would be similar to the Lower Bound Scenario; however, the additional wells would increase the total size of the CO_2 plume within the ROI. The plume radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
	Physiography and Soils	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to physiography and soils.	***Negligible to minor adverse impacts.*** Construction of the project would increase the potential for soil erosion and compaction, and creation of impermeable surfaces. Construction of the CO_2 capture facility would disturb 33 acres of previously disturbed urban land. Construction of the pipeline corridors would disturb sensitive or high-productivity soils: 6 acres of prime farmland, 13 acres of farmland of statewide importance, 15 acres of HEL, and 11 acres of PHEL. Construction of the injection well sites would disturb sensitive or high-productivity soils: 3.4 acres of farmland of statewide importance and 4.9 acres of HEL. Operation of the CO_2 capture facility, pipeline corridors, and injection well sites, would not be anticipated to affect soil resources.	***Negligible to moderate adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario for the CO_2 capture facility. Construction of the pipeline corridors would disturb sensitive or high productivity soils: 18 acres of prime farmland, 83 acres of farmland of statewide importance, 155 acres of HEL, and 29 acres of PHEL. Construction of the injection well sites would disturb less than an acre of prime farmland, 17.7 acres of farmland of statewide importance, 19.5 acres of HEL would not be accessible for future farming; higher potential of erosion from operational activities. Operation of the project would be similar to the Lower Bound Scenario.
	Groundwater	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their current conditions; there would be no changes to groundwater resources.	***Negligible to minor adverse impacts.*** Construction of the CO_2 capture facility and pipeline corridors would not include onsite discharges to groundwater, and implementation of Stormwater Construction Permit conditions would minimize any potential for groundwater contamination. Construction of the injection well sites would occur in a manner so that drilling mud would not interact with local groundwater and in a manner consistent with a UIC permit. Operation of the CO_2 capture facility would require potable water for 38 new employees, which is 0.7 percent of the unused capacity of the supplying sanitary district, which uses groundwater. Operations would include implementation of a Spill Prevention, Control, and Countermeasures Plan and NPDES permit conditions, which would minimize the potential for groundwater	***Negligible to minor adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario for the CO_2 capture facility. Construction of the pipeline corridors and injection well sites would be similar to the Lower Bound Scenario, though longer pipeline lengths and four additional wells, respectively, would increase the potential for groundwater exposure to contaminants. Operation of the project would be similar to the Lower Bound Scenario, though four additional wells would increase the total size of the CO_2 plume. The CO_2 radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	**Lower Bound Scenario (A)** ***2 wells at Mountaineer Plant*** ***2 wells at Borrow Area***	**Upper Bound Scenario (C)** ***2 wells at Borrow Area*** ***2 wells at Eastern Sporn Tract*** ***2 wells at Jordan Tract*** ***2 wells at Western Sporn Tract***
	contamination. Operation of the pipeline corridors would not be expected to affect groundwater. At the injection well sites, the potential of CO_2 migrating upward through fractures in the caprock seal is considered highly unlikely and extensive vertical movement to drinking water aquifers would not be expected. Based on preliminary results from the PVF injection wells, the CO_2 migration is anticipated to occur laterally, with minimal vertical migration within the target formations. As part of the UIC permit application, AEP would outline the monitoring and verification procedures, which are part of the carbon sequestration best management practices that AEP would implement.	
	Surface Water	
No impacts. The potential sites and corridors would remain in their existing states and there would be no changes to surface waters.	***Negligible to minor adverse impacts.*** Construction of the CO_2 capture facility and the upgrades to the barge unloading area has the potential to cause sedimentation to the Ohio River and increase the potential for surface water contamination from materials spills. Construction of the pipeline corridors could disturb surface waters causing a decrease in water quality, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation for a total of seven stream crossings. Construction of the injection well sites could increase the potential for contamination from material spills. Operation of the CO_2 capture facility would require additional process water withdrawals of 1.9 mgd from the Ohio River; would increase the potential for stormwater runoff due to increased impervious area; would increase wastewater discharge from the facility operations; and would increase the potential for contamination from materials spills. Operation of the pipeline corridors and injection well sites would not affect surface water, other than increasing the potential of material spills during maintenance.	***Negligible to moderate adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario for the CO_2 capture facility. Construction of the pipeline corridors could disturb surface waters causing a decrease in water quality, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation for a maximum potential of 12 perennial, 35 intermittent, and 60 ephemeral stream/creek crossings. Construction of the injection well sites would be similar to the Lower Bound Scenario, though there would be increased potential for contamination from material spills due to four additional wells. Operations of the project would be similar to the Lower Bound Scenario.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
	Wetlands and Floodplains	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no change to wetlands and floodplains.	***Minor adverse impacts.*** No wetlands exist at the CO_2 capture facility or the barge unloading area; however, both areas consist of FEMA-mapped floodplains. However, a nearby wetland area may experience sedimentation during construction of the upgrades to the barge unloading area. Construction of the CO_2 capture facility and the upgrades to the barge unloading area could increase flood elevations and redirect flood flows. Construction of pipeline corridors would disturb 5.36 acres of wetlands; no mapped floodplains would be affected. Construction activities associated with the potential injection well sites could cause sedimentation impacts to wetlands; no mapped floodplains would be affected. Operational maintenance requirements for pipeline corridors could result in permanent vegetation conversions within 2.59 acres of palustrine wetlands. No wetlands or floodplains would be affected during operations of the injection well sites.	***Minor adverse impacts.*** Construction impacts would be similar to the Lower Bound Scenario for the CO_2 capture and the barge unloading area. Construction of pipeline corridors would disturb between 6.52 and 6.73 acres of wetlands (minor impact) and 1.86 acres of mapped floodplains along Western Sporn Route. Construction activities associated with the potential injection well sites could cause sedimentation impacts to wetlands and floodplains at the Western Sporn Tract. Maintenance requirements for pipeline corridors could result in permanent vegetation conversions within 2.70 acres of palustrine wetlands.
	Biological Resources	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their current conditions; there would be no changes to biological resources.	***Negligible to moderate adverse impacts.*** Construction of the CO_2 capture facility, would involve the disturbance of 33 acres of disturbed industrial developed open space (i.e., grassy areas), which is of low habitat quality. Construction and grading activities associated with upgrades to the barge unloading area has the potential to cause sedimentation; however, implementation of erosion and sedimentation measures would be employed during construction to reduce the potential for adverse impacts to aquatic species. Construction of the pipeline corridors would involve the disturbance of vegetation and associated wildlife habitat (0 – 12.5 acres of agricultural land, 10.4 – 36.7 acres of forest, and 13.5 – 105.1 acres of grassland and scrub/shrub) and accidental	***Negligible to moderate adverse impacts.*** Potential impacts at the CO_2 capture facility would be the same as for the Lower Bound Scenario. Potential impacts for construction of the pipeline corridors would be the same as for the Lower Bound Scenario except a greater amount of land areas would be affected (up to 32.1 acres of agricultural land, up to 99.5 acres of forest, and up to 248.4 acres of grassland and scrub/shrub). For construction of the injection well sites, 16.4 acres of forest and associated wildlife habitat would be temporarily removed; no aquatic resources are present, thus, no impacts to aquatic species would be expected. Potential impacts for operation of the pipeline corridors would be the same as for the Lower Bound Scenario except a greater

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
	mortality of wildlife could occur due to collisions with vehicles and equipment. The potential also exists for the introduction and spread of invasive species (minor to moderate impact); habitat fragmentation, which would be minimized through the use of existing ROWs; and adverse impacts to migratory birds. Construction of the injection well sites would cause negligible impacts in terms of disturbances in previously developed land; no aquatic resources are present, thus, no impacts to aquatic species would be expected. The use of temporary piles to stabilize the barges during unloading has the potential to result in localized impacts to aquatic habitat and the potential for adverse impacts to less mobile aquatic species (e.g., mussels). Operation of the pipeline corridors would involve permanent habitat conversions (4.4 acres of forest and 5.5 acres of grassland and scrub/shrub). Impacts could also occur if a pipeline ruptured or leaked CO_2 in the form of elevated CO_2 concentrations for soil invertebrates and plant roots. Operation of the injection well sites would cause elevated pH of the underground sequestration environment, which can affect subsurface microbial communities.	amount of land areas would be affected (up to 22.5 acres of agricultural land, up to 62.4 acres of forest, and up to 160.0 acres of grassland and scrub/shrub). Potential impacts for operation of the injection well sites would be the same as for the Lower Bound Scenario except natural vegetated habitats would be permanently converted (2.1 acres of grassland and scrub/shrub and 5.2 acres of forest).
	Cultural Resources	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to cultural resources.	***Negligible adverse impacts.*** DOE has not identified any cultural resources that would be directly impacted. Other historic resources within applicable APEs would not be expected to incur any apparent or measurable impacts as the project would not be expected to alter the setting or other aspects of integrity of these resources. The project would not introduce visual, atmospheric, or audible elements that diminish the integrity of the resource's significant historic features.	***Negligible adverse impacts.*** Potential impacts would be the same as for the Lower Bound Scenario.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	**Lower Bound Scenario (A)** ***2 wells at Mountaineer Plant*** ***2 wells at Borrow Area***	**Upper Bound Scenario (C)** ***2 wells at Borrow Area*** ***2 wells at Eastern Sporn Tract*** ***2 wells at Jordan Tract*** ***2 wells at Western Sporn Tract***
	Land Use and Aesthetics	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to land use.	***Negligible to minor adverse impacts.*** Construction and operation of the project would not conflict with any designated zoning plans, and would be compatible with surrounding land uses. In addition, during construction of the CO_2 capture facility, pipeline corridors, and injection well sites, truck traffic and dust could be contributing factors for potential aesthetic impacts to residences located within 0.5 mile of the site. Operational long-term changes to land use and aesthetic value would occur from the permanent conversion of natural (forests or grasslands) or agricultural land cover to typically revegetated grass in the areas of the pipeline corridors and injection well sites (except for the 0.5 acre operational footprint around each well).	***Negligible to minor adverse impacts.*** Construction and operational impacts would be similar to the lower bound scenario for the CO_2 capture facility, and similar for the pipeline corridors and injection sites, though more land would be impacted due to longer pipeline corridors and four additional injection wells.
	Traffic and Transportation	
No impacts. The site and corridors would remain in their existing states. The transportation and traffic would remain unchanged from existing conditions.	***Minor to moderate adverse impacts.*** During peak construction conditions (2014) (moderate impact), the percent increase (from No-Build to Build conditions) in total daily vehicular traffic volumes on State Route 62 would range from 12 to 74 percent; the percent increase in peak one-way hour traffic volumes would range from 62 to 396 percent. LOSs on State Route 62 would temporarily degrade one to three levels; LOSs would range from C to D. Four rail deliveries and up to 30 barge deliveries are expected during construction. The increase would be short-term and would represent a 1-percent increase above baseline volumes. During operations (minor impact), the percent increase (from No-Build to Build conditions) in total daily vehicular traffic volumes on State Route 62 would range from 1 to 5 percent; the percent increase in peak one-way hour traffic volumes would range from 4 to 25 percent. LOSs on State Route 62 would remain similar to baseline conditions (A to C). Assuming the new facility would use	***Minor to moderate adverse impacts.*** During construction (moderate impact), traffic impacts would be slightly higher than the Lower Bound Scenario. During peak construction conditions (2014), the percent increase (from No-Build to Build conditions) in total daily traffic volumes on State Route 62 would range from 13 to 83 percent; the percent increase in peak one-way hour traffic volumes would range from 69 to 441 percent. LOSs on State Route 62 would temporarily degrade one to three levels; LOSs would range from C to D. Potential impacts to rail and barge systems during construction would be the same as for the Lower Bound Scenario. Potential impacts of overall project operations would be the same as for the Lower Bound Scenario.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
	rail to transport aqueous ammonia and sulfuric acid (for a total of up to 140 rail shipments per year), this would contribute to approximately 3 additional rail shipments (or 6 additional train pass-bys) in any given week. Compared to the existing rail traffic volume (approximately 8 train pass-bys per day or 56 train pass-bys per week), this additional traffic represents an approximately 11 percent increase in overall rail volume.	
Noise		
No impacts. The site and corridors would remain in their existing states. The noise environment would remain unchanged from existing conditions.	***Negligible to moderate adverse impacts.*** During construction of the CO_2 capture facility, potential increases in noise levels were estimated to be in the range of 8.9 to 15 dBA. Based on one study, predicted noise levels at nearby receptors analyzed near the CO_2 capture facility have the potential to exceed the EPA guideline threshold (L_{eq} of 48.6 dBA), but within or near levels classified by HUD as "acceptable" (L_{eq} of 58.6 dBA). Depending on proximity to any required blasting along the pipeline corridor, some receptors may experience minor to moderate vibration impacts. Noise levels are projected to be between 58.0 and 54.4 dBA for 30 receptors located between 2,000 and 3,000 feet of injection well MT-1. During operation of the CO_2 capture facility, predicted noise levels at some receptors have the potential to exceed the EPA guideline, but within levels classified by HUD as "acceptable" (sound levels of 47.2 to 53.2 dBA). It is not expected that clearly discernable increases in sound levels would occur at any of the receptors. During maintenance, certain activities could temporarily increase sound levels. There are approximately 30 receptors between 2,000 and 3,000 feet of MT-1 that could experience temporary noise impacts during maintenance activities.	***Negligible to moderate adverse impacts.*** Potential impacts at the CO_2 capture facility would be the same as for the Lower Bound Scenario. Predicted noise levels for receptors located 500 feet from the pipeline construction site, without and with horizontal directional drilling, are 64 and 67 dBA, respectively (number of affected receptors per route: BA Route – 0, ES Route 1 – 1, ES Route 2 – 2, ES Route 3 – 1, ES Route 4 – 3, JT Route 1 – 4, JT Route 3 – 5, JT Route 4 – 4, and WS Route – 19). Predicted noise levels for receptors located 1,000 feet from pipeline construction sites, without and with horizontal directional drilling are 58 and 61 dBA, respectively (number of affected receptors per route: BA Route – 0, ES Route 1 – 2, ES Route 2 – 12, ES Route 3 – 5, ES Route 4 – 16, JT Route 1 – 11, JT Route 3 – 15, JT Route 4 – 15, and WS Route – 42). During construction of the injection well sites (moderate impact), sound levels could reach 70.0, 64.0, and 58.0 dBA for receptors located within 500, 1,000, and 2,000 feet of the well construction site, respectively (number of receptors within 2,000 feet or projected sound levels greater than 58.0 dBA: BA-1 – 0; ES-1, ES-2, ES-3 – 12; JT-1 – 3; and WS-1 – 39). If AEP's noise evaluation determines that ambient sound levels at a receptor would experience a change greater than 5 dBA, AEP would evaluate sound mitigation measures to reduce noise levels.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) ***2 wells at Mountaineer Plant*** ***2 wells at Borrow Area***	Upper Bound Scenario (C) ***2 wells at Borrow Area*** ***2 wells at Eastern Sporn Tract*** ***2 wells at Jordan Tract*** ***2 wells at Western Sporn Tract***
		Potential impacts from noise during the operation of the pipeline corridors would be the same as for the Lower Bound Scenario.
	Materials and Waste Management	
No impacts. The site and corridors would remain in their existing states. Conditions related to material use and waste generation in the ROI would remain unchanged.	***Negligible to moderate adverse impacts.*** The project materials stored in the largest quantities would be anhydrous ammonia (80,000 lbs/year) and sulfuric acid (750 to 900 lbs/hour); the chemicals required to operate the proposed project are widely available. AEP would attempt to sell dry ammonium sulfate by-product to local and regional agricultural suppliers. The project has the potential to generate small amounts of hazardous waste and municipal solid waste that would be similar to waste streams currently generated and would be collected and transported offsite for disposal in accordance with applicable regulations. The amounts would not substantially affect the capacities of disposal service.	***Negligible to moderate adverse impacts***. Construction materials and wastes would be essentially the same as the Lower Bound Scenario except an additional quantity of materials and wastes for construction and operations would be generated due to the construction of more wells and additional length of pipeline corridors.
	Human Health and Safety	
No impacts. The site and corridors would remain in their existing states. Conditions related to human health and safety would remain unchanged.	***Minor adverse impacts.*** The potential for worker injuries and fatalities would be present during the construction of the CO_2 capture facility, pipeline corridors, and injections well sites. No worker fatalities would be expected. During facility operation, workers could be subject to physical and chemical hazards, which would be typical of those associated with power plant or similar facility operations. The projected number of recordable incidents per year is estimated to be 1.3, with 0.74 being lost time or restricted duty. The potential for catastrophic accidents at the CO_2 capture facility is considered to be unlikely (i.e., the potential to occur between once in 100 years and once in 10,000 years). Potential accidents or destructive acts at the CO_2 capture facility could result in the	***Minor adverse impacts***. Potential impacts related to worker injuries and fatalities would be the same as for the Lower Bound Scenario. The potential for catastrophic accidents or destructive acts at the CO_2 capture facility relating to the accidental release of ammonia would be the same as for the Lower Bound Scenario. Consequences from pipeline and injection well related CO_2 releases would be generally limited to workers or individuals with 50 to 150 feet of the release, and up to 1 individual could experience life-threatening effects, up to 1 individual could experience irreversible adverse effects, and up to 13 individuals could experience transient and reversible effects.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
	release of ammonia. Depending upon the worst-case accidental release scenarios of ammonia from the CO_2 capture facility, and depending upon the predominant wind directions, up to 13 individuals could experience life-threatening effects, up to 153 individuals could experience irreversible adverse effects, and up to 2,858 individuals could experience transient and reversible effects. Potential accidents or destructive acts on pipelines and injections wells could result in the release of CO_2 gases and trace compounds (e.g., ammonia). Consequences from pipeline and injection well related CO_2 releases would be generally limited to workers or individuals with 50 to 150 feet of the release, and up to one individual could experience life-threatening effects, up to one individual could experience irreversible adverse effects, and up to one individual could experience transient and reversible effects.	
	Utilities	
No impacts. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to utilities.	***Negligible to minor adverse impacts.*** Construction of the CO_2 capture facility would increase potable water demand from the NHWF by 0.5 percent to 16 percent of the current unused capacity and increase sanitary wastewater treatment by the NHSWF by 0.6 percent to 19 percent of the current unused capacity. AEP estimates that the vast majority of sanitary waste needs during construction would be provided by portable restrooms. The drilling of each well would require 50,400 gallons of fresh water over a period of a month; water sources could include existing surface waters, the ash pond, or the Mountaineer Plant. If the Mountaineer Plant ultimately is used as the source, the water requirement would represent a maximum of 4 percent of the NHWF's unused capacity. Operation of the CO_2 capture facility would increase potable water demand from the NHWF by 0.7 percent of the current	***Negligible to minor adverse impacts.*** Potential impacts would be the same as for the Lower Bound Scenario, except if the Mountaineer Plant ultimately is used as the source, the water requirement would represent a maximum of 9 percent of the NHWF's unused capacity.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	**Lower Bound Scenario (A)** ***2 wells at Mountaineer Plant*** ***2 wells at Borrow Area***	**Upper Bound Scenario (C)** ***2 wells at Borrow Area*** ***2 wells at Eastern Sporn Tract*** ***2 wells at Jordan Tract*** ***2 wells at Western Sporn Tract***
	unused capacity and increase sanitary wastewater treatment by the NHSWF by 0.9 percent of the current unused capacity.	
	Community Services	
No impacts. The area would remain in their existing states. There would be no changes in demands on community services.	***Negligible to minor adverse impacts.*** The work force for construction of the project (25 to 800 peak) is expected to be drawn from the ROI. Therefore, a large influx of construction workers relocating from outside the region is not anticipated. The influx of a smaller proportion of construction workers is not expected to substantially affect the capacities of regional law enforcement, fire protection, emergency response, health care, or school systems. DOE anticipates that a large portion of the 38 operational positions would be filled by workers already residing within the region. However, even if all 38 workers were to relocate to the region with families, they would not substantially affect the capacities of regional law enforcement, fire protection, emergency response, health care, or school systems.	***Negligible to minor adverse impacts.*** Potential impacts would be the same as for the Lower Bound Scenario.
	Socioeconomics	
Loss of potential benefit. Construction of the Mountaineer CCS II Project would not occur, and there would be no changes in demographic and socioeconomic conditions within the ROI. Given the status of the economy, employment, and income, the region would lose the potential for economic	***Beneficial impacts.*** Spending and employment for the project would generally result in net beneficial impacts to socioeconomic conditions during construction. The acquisition of land for the project would not require the displacement of population or demolition of housing. A temporary increase in population caused by a slight influx of construction workers from outside the ROI (a very small portion of the 25 to 800 peak construction work force) would not have an adverse impact on population and housing. The demand on the labor force in the ROI during construction of the project would not have an adverse impact on capacity, and the project would not	***Beneficial impacts.*** Potential impacts would be the same as for the Lower Bound Scenario.

Table S-5. Summary of Environmental Impacts of the Mountaineer CCS II Project

No Action	Lower Bound Scenario (A) *2 wells at Mountaineer Plant* *2 wells at Borrow Area*	Upper Bound Scenario (C) *2 wells at Borrow Area* *2 wells at Eastern Sporn Tract* *2 wells at Jordan Tract* *2 wells at Western Sporn Tract*
stimulus desired by regional development authorities.	adversely affect incomes and the regional economy. The potential influx of as many as 38 workers for project operations would not have a substantial effect on regional population and housing.	
Environmental Justice		
Loss of potential benefit. Construction of the Mountaineer CCS II Project would not occur. There would be no environmental justice impacts related to the project. However, the region would lose the potential for economic stimulus that could benefit low income populations.	***Negligible adverse impacts.*** No disproportionately high and adverse impacts to minority and low-income populations are anticipated during construction or operation of the project.	***Negligible adverse impacts.*** Potential impacts would be the same as for the Lower Bound Scenario.

AEP = American Electric Power Service Corporation; APE = Area of Potential Effects; CAP = chilled ammonia process; CCS = carbon capture and storage; CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; dBA = A-weighted decibel; DOE = U.S. Department of Energy; EPA = U.S. Environmental Protection Agency; FEMA = Federal Emergency Management Agency; GHG = greenhouse gas; HEL = highly erodible land; HUD = U.S. Department of Housing and Urban Development; lbs= pounds; Leq = equivalent sound level; LOS = level of service; mgd = million gallons per day; NHSWF = New Haven Sanitary Waste Facility; NHWF = New Haven Water Facility; NPDES= National Pollutant Discharge Elimination System; NRHP = National Register of Historic Places; PHEL = potentially highly erodible land; ROI = region of influence; ROW = right of way; tpy = tons per year; UIC = Underground Injection Control

POTENTIAL CUMULATIVE IMPACTS

DOE addressed the impacts of the Mountaineer CCS II Project incrementally when added to the reasonably foreseeable impacts of other significant known or proposed projects within the geographic area in accordance with the cumulative impact requirements of NEPA (40 CFR 1508.7). The projects described in Table S-6 are specifically included in the cumulative impacts analysis.

As a result of the cumulative impacts analysis, DOE concluded that the other potential projects in the ROI of the Mountaineer CCS II Project would have impacts on most resources that would be substantially separated by distance from the potential impacts of the project. Therefore, DOE did not identify potential impacts that would incrementally add to those of the project such that they would cause cumulative impacts significantly greater than the impacts of the Mountaineer CCS II Project and the other projects taken independently.

CONCLUSIONS

As with the development of any large industrial project, the construction and operation of the Mountaineer CCS II Project, including the CO_2 capture facility, associated infrastructure and pipelines, and injection and monitoring wells, would impact the surrounding environment. Analyses indicate the project could have beneficial impacts to regional socioeconomics and to reducing greenhouse gas emissions; the project could have moderate adverse impacts to biological resources, noise levels, traffic conditions, and materials and waste management; and could have negligible to minor adverse impacts on the remaining resource areas in the ROI.

DOE's proposed action would support the CCPI Program in demonstrating advanced coal-based technologies at a commercial scale that capture and geologically sequester CO_2 emissions. The proposed action would satisfy the responsibility Congress imposed on DOE to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The CCPI Program selects projects with the best chance of achieving the program's objectives as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial service. DOE believes that accelerated commercial use of these new or improved technologies will help to sustain economic growth, yield environmental benefits, and produce a more stable and secure energy supply.

DOE also recognizes the controversies surrounding the continued dependence on coal by the power industry and the need to address the associated environmental and climate change challenges related to the continued use of coal. However, as the most abundant fossil fuel resource in the U.S., coal will continue to play an important role in the nation's energy supply. The Mountaineer CCS II Project would capture and geologically store up to 1.5 million metric tons per year of the CO_2 that is currently emitted by the Mountaineer Plant to the atmosphere. DOE considers the technological advancement and commercialization of CCS as an important component of maintaining energy supplies while minimizing environmental impacts associated with using fossil fuel resources.

Table S-6. Regional Projects Identified for Consideration in the Cumulative Impacts Analysis

Site	Location	Distance (Miles)	Status	Description
Yellowbush Coal Mine	Meigs County, OH	1.5	Active; Potential Future Expansion	Yellowbush Coal Mine is located in Meigs County, Ohio and operated by Gatling Ohio LLC. In January 2009, the USACE issued a Section 404 permit for the Yellowbush Mine docking facility (Meigs Point Dock) on the Ohio River. Yellowbush mine is on the Ohio Department of Natural Resources Pending Coal Application list (7/31/10).
Green Global, LLC	New Haven, WV	0	Ongoing; Permit to Construct (R13-2845) Issued from WVDEP - July 2010	Mining and quarrying of non-metallic minerals. Green Global, LLC constructed and operates a portable crushing and screening plant using water-based gravity separation to recover manganese slag.
AEP Mountaineer CCS Geologic Characterization Study	New Haven, WV	0	Ongoing; Scheduled to be completed by June 2011	As part of the characterization studies, AEP plans to initially install geologic characterization wells at the Borrow Area and the Jordan Tract in order to collect data of both caprock and target injection formations. If sufficient data is not obtained from these wells to determine injection well placement and design parameters, then additional characterization wells could be installed at one or more of the remaining injection well properties.
AEP Mountaineer CCS PVF	New Haven, WV	0	Ongoing; To be decommissioned before project is brought online	Ongoing small-scale PVF at the existing Mountaineer Plant. With implementation of the project, the PVF would be decommissioned with long-term monitoring conducted as part of the overall project and in accordance with the WVDEP UIC permit.
Broad Run Coal Mine	New Haven, WV	0	Potential Closure	Broad Run Coal Mine continues to remain inactive after April 2010 layoffs, and may be closed in the future. Current operations include at least one mobile mining unit. The underground mine is operated by Big River Mining.
American Municipal Power	Letart Falls (Meigs County), OH	5	Potential Future	Proposed 600 MW natural gas power plant announced on August 19, 2010. No natural gas pipelines in the area. Same location as cancelled 1,000 MW coal power plant. Proposed to be operational by 2014.
Byrd Dam	Gallipolis (Gallia County), OH	18	Potential Future	Proposed 48 MW hydroelectric power plant. Federal Energy Regulatory Commission license application may be submitted in 2010. The application approval process can take 2 years or more.
Mason County Airport Runway	Mason County, WV	9	Ongoing Construction	$2 million Federal Aviation Administration grant for redevelopment of runway. The Mason County Development Authority identified this project as currently underway.
Armstrong Mineral Wool Plant	Jackson County, WV	15	Ongoing Construction	Armstrong World Industries is constructing an environmentally friendly mineral wool plant on 35 acres in the Jackson County Industrial Center in Millwood, WV.

Table S-6. Regional Projects Identified for Consideration in the Cumulative Impacts Analysis

Site	Location	Distance (Miles)	Status	Description
U.S. Route 35	Putnam County, WV	30	Ongoing Construction	Approximately 14 miles of U.S. Route 35 remains to be constructed. When complete, this road will extend 35 miles from Crooked Creek (Putnam County) to Point Pleasant (Mason County).
Kenna Ridge Business Park	Jackson County, WV	21	Ongoing Construction	New business park on 64 acres in Kenna, WV.
Proposed Sewer Improvements	Leon and New Haven, WV; Gallia County, OH	0-60	Ongoing Construction / Potential Future	Various local sewer improvement projects within the ROI. Potential cumulative beneficial effect to groundwater and surface water.
Proposed Road Improvements	Gallia County, OH; Mason County, WV	15-20	Ongoing Construction / Planned	Various local West Virginia Department of Transportation and Ohio Department of Transportation road improvement projects, including widening of existing roads. Potential cumulative beneficial effect to transportation and traffic.

CCS = carbon capture and storage; LLC = Limited Liability Company; MW = megawatt; OH = Ohio; PVF = product validation facility; ROI = region of influence; UIC = Underground Injection Control; USACE = U.S. Army Corps of Engineers; WV = West Virginia; WVDEP = West Virginia Department of Environmental Protection

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1 PURPOSE AND NEED FOR AGENCY ACTION

1.1 INTRODUCTION

The United States (U.S.) Department of Energy (DOE) prepared this Environmental Impact Statement (EIS) to evaluate the potential environmental, cultural, and socioeconomic impacts associated with the DOE Proposed Action of providing financial assistance for the Mountaineer Commercial Scale Carbon Capture and Storage (CCS) Project (Mountaineer CCS II Project) under the Clean Coal Power Initiative (CCPI) Program.

DOE prepared this EIS pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] 4321 *et seq.*), and in compliance with the Council on Environmental Quality (CEQ) implementing regulations for NEPA (40 *Code of Federal Regulations* [CFR] 1500 through 1508) and DOE's NEPA implementing procedures (10 CFR 1021). Chapter 1 of the EIS provides an overview of the Proposed Action and a description of the purpose and need for DOE action. This chapter also includes information on the NEPA process and the "scoping" efforts completed by DOE during planning and development of the EIS. "Scoping" refers to the public, tribal, and agency outreach efforts that DOE undertook early in the process to focus this NEPA analysis on the appropriate issues (please see 40 CFR 1501.7 and Section 1.6 for more information).

1.2 CCPI PROGRAM

Congress established the CCPI Program to enable and accelerate the deployment of advanced technologies to ensure clean, reliable, and affordable electricity for the U.S. The CCPI operates as a cost-shared partnership between government and industry to develop and demonstrate advanced coal-based power generation technology at the commercial scale. CCPI demonstrations address the reliability and affordability of the nation's electricity supply and further the objectives of the Energy Policy Act of 2005 (EPAct05). The overall goals of the CCPI are to: (1) increase investment in low-emission, coal-based power generation technology, consistent with the EPAct05 (Public Law 109-58); and (2) accelerate the development and demonstration of advanced coal technologies for commercial use. By providing federal assistance, potential solutions to inherent financial and technical risks (on the part of the commercial sector) associated with bringing advanced technology to the marketplace can be more rapidly developed. In this manner, the CCPI accelerates the development of new coal technologies and facilitates the commercial acceptance of these emerging technologies.

The CCPI legislation specifically directs DOE to demonstrate coal-based technology advancements, thereby reducing barriers to the continued and expanded use of coal to generate electricity. When integrated with other DOE initiatives, the CCPI will help the nation successfully commercialize these advanced technologies. Such technologies will produce electricity at greater efficiencies, attain near-zero emissions, and produce clean fuels consistent with the EPAct05. By reducing emissions, the CCPI also directly supports the Climate Change Technology Program (CCTP) to reduce emissions of carbon dioxide (CO_2), a greenhouse gas (GHG). The CCTP is the planning and coordination entity that assists the government in carrying out the President's National Climate Change Technology Initiative. Its purpose is to accelerate the development and deployment of technologies that can reduce, avoid, or capture and store GHG emissions. The CCTP was established in 2002 with several participating federal agencies, including the U.S. Environmental Protection Agency (EPA) and DOE.

> Carbon dioxide (CO_2) accounts for 83 percent of the total U.S. GHG emissions. As of 2008, the CO_2 emissions from U.S. electricity generation had grown 30 percent since 1990, while in comparison, total CO_2 emissions (from all reported U.S. sources) grew by only 16 percent. Electrical power generation contributes 41 percent of all CO_2 emissions in the U.S. In 2008, 82 percent of all CO_2 emissions from U.S. electricity generation was attributable to the use of coal (EIA, 2009b).

DOE selects the CCPI projects for financial assistance through funding opportunity announcements (FOA) that solicit applications for federal cost-sharing for demonstration projects. To date, the CCPI Program has conducted three rounds of solicitations:

- *Round 1* sought projects that would demonstrate advanced technologies for power generation and improvements in plant efficiency, economics, and environmental performance.
- *Round 2* requested applications for projects that would demonstrate improved mercury controls and gasification technology.
- *Round 3* which DOE conducted in two phases, sought projects that would demonstrate advanced coal-based electricity generating technologies that capture and sequester (or put to beneficial use) CO_2 emissions. The Round 3 solicitation was restricted to coal-based power generation, with a specific objective to demonstrate advanced coal-based technologies that capture and sequester (or put to beneficial use) CO_2 emissions.[1]

American Electric Power Service Corporation (AEP) submitted an application for its proposed Mountaineer CCS II Project in response to the CCPI Round 3 solicitation. As described in Section 1.6.4 and 2.2.2, DOE selected AEP's project and four other applications for possible funding pending further, more detailed consideration. The DOE determined that five projects would best meet CCPI's goals and objectives.

1.3 PROPOSED ACTION

1.3.1 Proposed Agency Action

DOE's Proposed Action is to provide financial assistance to AEP under the CCPI Program to support construction and operation of AEP's Mountaineer CCS II Project.[2] DOE proposes to provide AEP with up to $334 million of the project cost. This funding would constitute about 50 percent of the estimated total project cost during the 46-month demonstration period. The following provides a summary description of AEP's proposed project; please refer to Section 2.3 for more information.

> The Proposed Action being considered by DOE is whether to provide cost-shared funding to the Mountaineer CCS II Project. This project includes capturing CO_2 from an existing power plant and injecting it into deep geologic formations for permanent storage.

1.3.2 AEP's Proposed Project

AEP proposes to construct a commercial-scale CCS system at its Mountaineer Power Plant (a 1,300-megawatt [MW] coal plant) and other AEP-owned properties located near New Haven, West Virginia. The project would capture CO_2 from this existing pulverized coal power plant, transport the captured CO_2

[1] As stated in the Financial Assistance FOA for Round 3, "DOE's specific objective is to demonstrate advanced coal-based technologies that capture and sequester, or put to beneficial use, CO_2 emissions. DOE's goals are to demonstrate at commercial scale in a commercial setting, technologies that (1) can achieve a minimum of 50 percent CO_2 capture efficiency and make progress toward a target CO_2 capture efficiency of 90 percent in a gas stream containing at least 10 percent CO_2 by volume, (2) make progress toward capture and sequestration goal of less than 10 percent increase in the cost of electricity for gasification systems and less than 35 percent for combustion and oxycombustion systems all as compared to current (2008) practice, and (3) capture and sequester or put to beneficial use a minimum of 300,000 tons per year of CO_2 emissions using a 30-day running average to determine if the project successfully meets the CO_2 capture efficiency and the capture and sequestration or beneficial use rate requirements of this Announcement" (NETL, 2009).

[2] Throughout this EIS, the term "Mountaineer CCS II Project" is used to describe the entire AEP proposal, including proposed components of the project. These are briefly described in this section and in more detail in Chapter 2.

by pipeline to well locations, and inject it into saline formations approximately 1.5 miles (7,920 feet) below the earth's surface for permanent geologic storage.

As part of the project, AEP would construct a CO_2 capture facility using Alstom's chilled ammonia process (CAP) at the Mountaineer Plant. Alstom's CAP is a proprietary process for removing CO_2 from combustion flue gas. The capture facility would be located within the boundaries of the Mountaineer Plant and would occupy approximately 11.5 acres (i.e., 500 feet by 1,000 feet). The capture facility would process a slipstream of the Mountaineer Plant's flue gas, equivalent in quantity to the flue gas emissions from a 235-MW power plant. Each year, approximately 1.5 million metric tons of CO_2 would be captured, treated, and compressed into a highly concentrated form suitable for geologic storage. The processed CO_2 would be transported by pipeline (primarily underground) to injection wells on AEP properties. These properties are located within approximately 12 miles of the Mountaineer Plant in Mason County, West Virginia. The captured CO_2 would be injected into deep saline formations for permanent storage.

Consistent with DOE's objectives under CCPI Round 3, the Mountaineer CCS II Project would be designed to

- remove approximately 90 percent of the CO_2 from the 235-MW slipstream;
- demonstrate a commercial-scale deployment of the CAP for CO_2 capture; and
- demonstrate the injection, permanent geologic storage, and monitoring of CO_2 in deep underground saline formations.

Existing infrastructure (e.g., roadways, utilities) would be used to the extent possible. However, upgrades to, and construction of, additional infrastructure may be required. Major new equipment would include absorbers, regenerators, strippers, pumps, heat exchangers, compressors, and a refrigeration system. In addition, the system would include reagent and refrigerant unloading equipment, water-handling equipment, a control room, maintenance and administrative facilities, and a laboratory, all of which would be located at the Mountaineer Plant. Carbon dioxide injection wells and pipelines would be located along existing rights-of-way (ROW) to the extent possible and on other AEP properties in the area.

1.4 PURPOSE AND NEED FOR AGENCY ACTION

The *purpose* of DOE's Proposed Action under the CCPI Program is to demonstrate advanced coal-based technologies at a commercial scale that capture and geologically sequester CO_2 emissions.

> The purpose of and need for DOE action is to advance the CCPI Program by funding projects with the best chance of achieving the program's objectives as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial use.

The principal *need* addressed by DOE's Proposed Action is to satisfy the responsibility Congress imposed on DOE to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The CCPI Program selects projects with the best chance of achieving the program's objectives as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial service.

This proposed project would help DOE, through the CCPI Program, meet its congressionally mandated mission to support advanced clean-coal technology projects. This specifically includes those projects that have progressed beyond the research and development stage to a point of readiness for operation at a scale that, once demonstrated, can be readily implemented across the commercial sector. Post-combustion CO_2 capture offers the greatest near-term potential for reducing power sector CO_2 emissions because it can be used to retrofit existing coal-based power plants and can also be tuned for various levels of CO_2 capture, which may accelerate market acceptance (NETL, 2010a). A successful demonstration of Alstom's CAP at the Mountaineer Plant would generate technical, environmental, and financial data from the design, construction, and operation of the facility. These data would confirm that the deployed technologies can be effectively and economically implemented at a commercial scale. Furthermore, the cost-shared financial assistance from DOE would reduce the risk to AEP in demonstrating this technology.

1.5 NATIONAL ENVIRONMENTAL POLICY ACT

1.5.1 DOE Responsibilities

NEPA requires all federal agencies to include, in every recommendation or report on proposals for major federal actions that may significantly affect the quality of the human environment, a detailed statement by the responsible agency describing: (1) the potential environmental impacts of the Proposed Action; (2) any adverse environmental effects that cannot be avoided should the proposal be implemented; (3) alternatives to the Proposed Action, including the alternative of taking no 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 agencies that have jurisdiction or special expertise with respect to any environmental impact involved, and that the detailed statement along with the comments and views of consulted governmental agencies be made available to the public (42 USC 4332).

DOE developed a two-phased review process to comply with NEPA for the CCPI Program. During the first phase of the process, DOE announced the open solicitation which initiated a competitive selection process to obtain a set of projects meeting the needs of the CCPI Program. Applications received in response to the solicitation were screened for compliance with the basic eligibility requirements set forth in the announcement. Evaluation of the applications focused on the technical description of the proposed project, financial plans and budgets, potential environmental impacts, and other information that the applicants were requested to submit. To aid in the environmental evaluation, the applicants provided information on the site-specific environmental, health, safety, and socioeconomic aspects of their project. DOE documented the potential environmental consequences for each application in an environmental critique that was presented to the merit review board. The results are summarized in a publicly available environmental synopsis (see Appendix A), prepared in accordance with DOE's NEPA implementing regulations.

Following separate reviews by technical, environmental, and financial panels, and a comprehensive assessment by a merit review board, DOE officials selected projects for potential funding. By broadly soliciting proposals to meet the programmatic purposes and needs for DOE action and by evaluating the potential environmental impacts associated with each proposal before selecting projects that would go forward, DOE considered a reasonable range of alternatives for implementing CCPI.

In the second phase of the NEPA process, DOE determined that providing financial assistance for the construction and operation of the Mountaineer CCS II Project would constitute a major federal action that could significantly affect the quality of the human environment. DOE prepared this EIS to inform its decision-making with respect to providing financial assistance to AEP for support of the Mountaineer CCS II Project. DOE used information provided by AEP and other project team members for the proposed project, as well as information provided by state and federal government agencies, and subject-matter experts. DOE prepared this EIS in accordance with Section 102(2)(C) of NEPA, as implemented under regulations promulgated by CEQ (40 CFR 1500 through 1508), and DOE's NEPA implementing procedures (10 CFR 1021). DOE's NEPA regulations (10 CFR 102.216) establish a specific procedure for reviewing projects seeking financial assistance prior to DOE deciding which ones to select. This EIS is organized according to CEQ recommendations (40 CFR 1502.10).

Figure 1-1 illustrates the steps involved in the EIS process. To formally initiate the NEPA process, DOE published a Notice of Intent (NOI) to prepare an EIS in the *Federal Register (FR)* on June 7, 2010, under Docket ID No. FR Doc. 2010–13568 (75 FR 13568). After issuing the NOI, DOE conducted a thorough scoping process that included a public scoping meeting and consultation with various interested governmental agencies and stakeholders. Information related to the public scoping meeting is described in Appendix B, and consultation-related correspondence is provided in Appendix C. The results of the scoping efforts were used by DOE to define the scope and areas of emphasis (or focus) of this EIS.

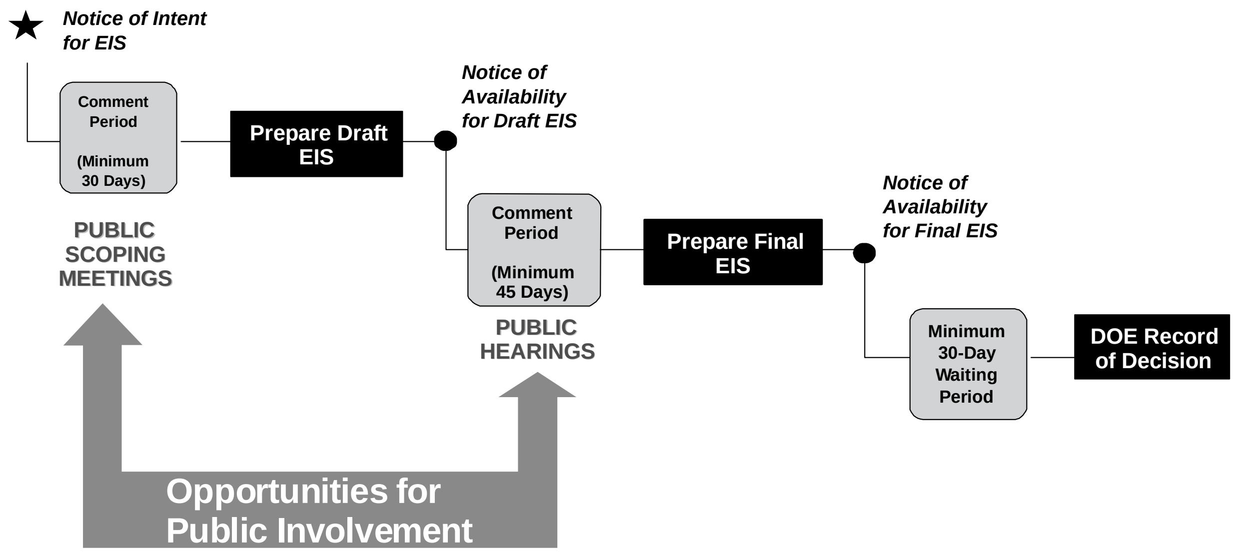


Figure 1-1. Steps in the NEPA Process

DOE has distributed the Draft EIS to interested parties and published a Notice of Availability (NOA) in the *Federal Register*. A separate NOA was published by the EPA. Beginning with publication of the NOA, DOE established a 45-day public review and comment period on the Draft EIS. During this period, DOE plans to hold a public hearing in the New Haven area to solicit public comments on the Draft EIS. DOE will consider and respond to all substantive comments received on the Draft EIS, both individually and collectively. DOE will address those comments in a Final EIS that will be distributed to the public and other stakeholders. Upon DOE's publication and distribution of the Final EIS, the EPA will publish an NOA in the *Federal Register*, at which point DOE will observe a minimum 30-day waiting period before issuing an agency decision. Upon completion of the waiting period, DOE will publish a Record of Decision (ROD) in the *Federal Register* stating the agency's decision whether to provide financial assistance for the AEP Mountaineer CCS II Project and documenting any special requirements and mitigation measures, if necessary.

1.5.2 Cooperating Agencies

A federal, state, tribal, or local agency having special expertise with respect to an environmental issue or jurisdiction by law may be a cooperating agency in the NEPA process. A cooperating agency has the responsibility to assist the lead agency by: (1) participating in the NEPA process at the earliest possible time; (2) participating in the scoping process; (3) developing information and preparing environmental analyses, including portions of the EIS for which the cooperating agency has special expertise; and (4) making staff support available at the lead agency's request to enhance the lead agency's interdisciplinary capabilities.

No cooperating agencies have been identified at this time.

1.6 SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

1.6.1 NEPA Scoping Process

This EIS assesses the potential environmental impacts of the Proposed Action and the No Action Alternative. DOE determined the scope of this EIS based on internal planning and analysis, consultation with federal and state agencies, and involvement of the public.

During the public scoping period, DOE solicited public input to ensure that: (1) significant issues were identified early and properly analyzed; (2) issues of minimal significance would not consume excessive time and effort; and (3) the EIS would be thorough and balanced, in accordance with applicable regulations and guidance (see Section 1.1).

DOE held a public scoping meeting on June 22, 2010 at the New Haven Elementary School in New Haven, West Virginia. DOE published notices in the following local newspapers announcing the meeting location and time: *The Daily Sentinel* and *The Point Pleasant Register* (June 8 and June 22), and the *Sunday Times Sentinel* (June 13 and June 20). DOE also announced the meeting in its NOI published in the *Federal Register* on June 7, 2010. This meeting was attended by seven members of the public, as well as project staff from DOE, AEP, and its other project partners.

The scoping meeting began with an informal open house from 5:00 p.m. to 7:00 p.m. During this time, attendees were able to view project-related posters, handouts, and video; and ask questions of DOE and AEP representatives. The informal open house was followed by a formal presentation and comment period, which were both transcribed by a court reporter. The public scoping period ended on July 9, 2010 after a 30-day comment period. During the comment period, DOE accepted comments by telephone, facsimile, U.S. mail, and electronic mail. Appendix B provides additional information on the NEPA public scoping process for this project.

1.6.2 Issues Identified Prior to the Scoping Process

DOE initially identified the following environmental resource areas for consideration in the EIS. These resource areas were identified in early planning efforts and listed in the NOI. This list was neither intended to be all-inclusive, nor a predetermined set of resources to be assessed for potential environmental impacts:

- Air quality resources
- Water resources
- Infrastructure and land use
- Visual resources
- Solid wastes
- Ecological resources, including threatened and endangered species and species of special concern
- Floodplains and wetlands
- Traffic
- Historic and cultural resources, including historic structures and properties, sites of religious and cultural significance to tribes, and archaeological resources
- Geology
- Health and safety
- Noise
- Socioeconomics, including impacts to community services and Environmental Justice

1.6.3 Comments Received and Issues Identified During the Scoping Period

DOE received two scoping comments at the scoping meeting. One commenter spoke at the public scoping meeting during the formal comment period. Although this commenter did not have a specific comment about the scope of the project, he spoke about the history of the AEP Mountaineer Power Plant, development and deployment of air emission control technologies, and his hope that the Mountaineer CCS II Project would be successful. One local landowner spoke with a DOE representative at the public scoping meeting, but did not wish to comment during the formal comment period or submit her comment in writing. This individual owns property adjacent to the northern boundary of AEP's property. Although the property is serviced by city water, there was concern about potential impacts to drinking water wells as a result of leaks of CO_2. DOE received no other comments during the 30-day scoping period. Three people submitted requests to receive a copy of the Draft EIS and/or the Final EIS or Summary.

Although most of the resource areas initially identified by DOE received little or no attention from the public during the scoping period, the EIS nevertheless addresses potential impacts to the areas identified during both internal planning and public scoping for the proposed project.

1.6.4 Agency Decision-Making Process

DOE's alternatives to its Proposed Action for CCPI - Round 3 consist of the other technically acceptable applications received in response to the FOA. DOE received 36 applications that met the minimum eligibility requirements. These applications provided DOE with a range of options for meeting the objectives of Round 3 of the CCPI. DOE screened each of these 36 applications to evaluate potential environmental consequences of each application during DOE's initial review and made preliminary determinations regarding the level of NEPA review required.

DOE documented the potential environmental consequences for each application in an environmental critique and summarized the results in a publicly available environmental synopsis (see Appendix A). DOE prepared this synopsis in accordance with DOE's NEPA implementing regulations, as found in 10 CFR 1021.216(h). Through this review process, DOE considered both potential environmental consequences and the ability of each application to meet the purpose of and need for action. DOE uses the procedures established in its NEPA regulations, specifically those in 10 CFR 1021.216, to identify and consider the potential environmental impacts of the eligible projects in making its selections as described in Section 1.5.1. The preliminary NEPA determinations and environmental reviews were provided to the selecting official for consideration during the selection process.

Ultimately, DOE determined that the proposed Mountaineer CCS II Project and four other applications would best meet the goals and objectives of the CCPI Program. The proposed projects from these five applications must each complete a separate, independent, project-specific (and more detailed) NEPA analysis that would each be expected to result in separate RODs. Although these five projects are eligible for cost-shared funding under CCPI, there is no other relationship among them. The selection and potential execution of each stand-alone project has no effect or bearing on the other projects.

This EIS identifies and analyzes the potential impacts of the Mountaineer CCS II Project at the proposed locations near New Haven, West Virginia (please see Chapter 3). No alternative CCS sites are being analyzed in this EIS, as DOE's pending decision is related to providing AEP with financial assistance based on the project attributes as described in AEP's Round 3 CCPI application. However, this EIS analyzes AEP's siting options for various components of the Mountaineer CCS II Project (e.g., injection well sites, CO_2 pipeline corridors, etc.). Chapter 2 discusses all of the aspects of the project in detail.

Evaluations of potential impacts included in this EIS are intended to assist the federal decision-makers in deciding whether to provide CCPI cost-shared funding to AEP for the Mountaineer CCS II Project. If DOE decides to provide financial assistance for the project, DOE may also specify measures to mitigate potential impacts. AEP would be required to implement the measures identified through the NEPA process in order to continue receiving DOE funds for the project. In the absence of DOE cost-shared funding (the No Action Alternative), AEP might elect to construct and operate the Mountaineer CCS II Project using alternative funding mechanisms. However, for purposes of analysis in this EIS, the No Action Alternative is defined as a "no-build" scenario under which it is assumed that the project would not be constructed in the absence of DOE funding (see Section 2.2.2.1).

No sooner than 30 days after publication of EPA's NOA of the Final EIS in the *Federal Register*, DOE will announce in a ROD the selection of either the Proposed Action or the No Action Alternative. Should the Proposed Action be selected in the ROD, AEP would make the additional engineering design decisions to ensure compliance with any required conditions contained in the ROD.

2 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter describes DOE's Proposed Action and the alternatives considered. DOE's Proposed Action and No Action Alternative are described in Section 2.2, along with a discussion of the other alternatives that DOE considered. Section 2.3 describes AEP's proposed Mountaineer CCS II Project and includes detailed descriptions of the following proposed project components:

- CO_2 capture facility
- CO_2 pipelines and corridors
- CO_2 injection and monitoring well locations
- Resources required
- Construction and operation plans
- CO_2 monitoring, verification, and accounting (MVA) activities
- Measures to reduce potential impacts

Section 2.4 presents project implementation options being considered by AEP and the manner in which these options are analyzed within this EIS.

2.2 PROPOSED AGENCY ACTION AND ALTERNATIVES CONSIDERED

2.2.1 DOE Proposed Action

DOE's Proposed Action includes a 46-month demonstration period that would validate an advanced coal-based technology that captures and sequesters CO_2 emissions from a coal-fired power plant.

DOE proposes to provide cost-shared financial assistance to AEP for the planning, design, construction, and operation of the proposed project. DOE's Proposed Action is to provide AEP with up to $334 million of the $668 million (in "as-spent," or actual dollars) estimated project cost. The financial assistance provided by DOE would constitute about 50 percent of the estimated total project cost. The project would help DOE meet a specific objective of Round 3 of the CCPI Program by demonstrating an advanced coal-based technology that captures and sequesters, or puts to beneficial use, CO_2 emissions from a coal-fired power plant (see Section 1.2). The proposed project is described in detail in Section 2.3.

2.2.2 Alternatives Considered by DOE

Section 102 of NEPA requires that agencies discuss the reasonable alternatives to the Proposed Action in an EIS. The term "reasonable alternatives" is not self defining, but rather must be determined in the context of the statutory purpose expressed by the underlying legislation. The purpose and need for a federal action determines the reasonable alternatives for the NEPA process.

Any reasonable alternative to the Proposed Action must be capable of satisfying the purpose and need of the CCPI Program. As described in Section 1.2 of this EIS, Congress established the CCPI Program with a specific goal—to accelerate the commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The narrow focus of the CCPI legislation directs DOE to demonstrate coal-based technology advancements, thereby reducing the barriers to continued and expanded use of coal to generate electricity.

Alternatives considered by DOE originate as private-party (e.g., electric power industry) applications submitted to DOE in response to requirements specified in CCPI solicitations. DOE is limited to considering the application as proposed by the applicant. For example, DOE cannot consider site or technology combinations other than those included in the applications received. The applicant provides at least a 50-50 cost share and bears the primary responsibility for designing and executing the project. DOE's primary action concerning these applications is to decide which projects would receive DOE financial assistance from among the eligible applications submitted. Unlike a project initiated and operated by DOE, DOE does not have the ability to make decisions concerning the location, layout, design, or other features of the project. In other words, DOE must select among the eligible projects submitted to DOE by the applicant; DOE cannot design its own project and compel a private entity to implement it.

DOE's decision is to either accept or reject the project as proposed by the proponent, including its proposed technology and selected sites. However, DOE may specify mitigation measures that would be required as part of the proposed action. DOE's proposed action is limited to providing financial assistance in cost-sharing arrangements to projects that were submitted by applicants in response to a competitive funding opportunity. Consequently, DOE's consideration of reasonable alternatives is also limited to the technically acceptable applications and the No Action Alternative for each selected project.

2.2.2.1 No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the proposed Mountaineer CCS II Project. In this case, the funding withheld from the Mountaineer CCS II Project may be made available for other current or future CCPI projects. In the absence of DOE cost-shared funding, AEP could still elect to construct and operate the proposed project; therefore, the DOE No Action Alternative could result in one of two potential scenarios:

- The proposed Mountaineer CCS II Project would not be built.
- The proposed Mountaineer CCS II Project would be built by AEP without benefit of DOE cost-shared funding.

DOE assumes that if AEP proceeded with project development in the absence of DOE cost-shared funding, the project would include the features, attributes, and impacts as described for the Proposed Action. However, without DOE participation, it is possible that the project would be canceled. Therefore, for the purposes of analysis in this EIS, the DOE No Action Alternative is defined as the No-Build Alternative. This means that the project would not be built and environmental conditions would not change from the current baseline (i.e., no new construction, resource utilization, or CO_2 capture and storage would occur).

Therefore, under the No Action Alternative, the project technologies (i.e., large-scale CO_2 capture and geologic storage) may not be implemented in the near term. Consequently, timely commercialization of these technologies for large-scale, coal-fired electric generation facilities would be postponed and may not be realized. This scenario would not contribute to the CCPI goals to invest in the demonstration of advanced coal-based power generation technologies that capture and sequester, or put to beneficial use, CO_2 emissions. While the No Action Alternative would not satisfy the purpose of or need for the Proposed Action, this alternative was retained to provide a comparative baseline against which to analyze the effects of the Proposed Action, as required under CEQ Regulations (40 CFR 15012.14). The No Action Alternative reflects the current baseline condition and serves as a benchmark against which the effects of the Proposed Action can be evaluated.

2.2.2.2 Alternative Project Applications Considered During the CCPI Procurement Process

DOE's alternatives to its Proposed Action for CCPI - Round 3 consist of the other technically acceptable applications received in response to FOA DE-FOA-0000042, *Clean Coal Power Initiative - Round 3, Amendments 005 and 006*. DOE received 36 applications that met the minimum eligibility requirements listed in the FOA under Round 3 of the CCPI. These applications provided DOE with a range of options for meeting the objectives of Round 3 of the CCPI. DOE screened each of these 36 applications to evaluate potential environmental consequences of each application during DOE's initial review and made preliminary determinations regarding the level of NEPA review required. DOE documented the potential environmental consequences for each application in an environmental critique and summarized the results in a publicly available environmental synopsis (see Appendix A). DOE prepared this synopsis in accordance with DOE's NEPA implementing regulations, as found in 10 CFR 1021.216(h). Through this review process, DOE considered both potential environmental consequences and the ability of each application to meet the purpose of and need for action. DOE uses the procedures established in its NEPA regulations, specifically those in 10 CFR 1021.216, to identify and consider the potential environmental impacts of the eligible projects in making its selections as described in Section 1.5.1. The preliminary NEPA determinations and environmental reviews were provided to the selecting official for consideration during the selection process.

Ultimately, DOE determined that the proposed Mountaineer CCS II Project and four other applications would best meet the goals and objectives of the CCPI Program. The proposed projects from these five applications must each complete a separate, independent, project-specific (and more detailed) NEPA analysis that would each be expected to result in separate RODs. Although these five projects are eligible for cost-shared funding under CCPI, there is no other relationship among them. The selection and potential execution of each stand-alone project has no effect or bearing on the other projects.

2.2.3 Project Options Considered by the Project Proponent

AEP responded to the DOE's solicitation with its application for the proposed project, which is based on a commercial scale-up of the existing CAP product validation facility (PVF), constructed at the Mountaineer Plant in 2009. The PVF captures CO_2 from a 20-MW flue gas slipstream and injects the captured CO_2 into two deep geologic formations via two wells located on the Mountaineer Plant property. The PVF is providing AEP with the opportunity to evaluate Alstom's CAP for CO_2 capture. The PVF project is successfully integrating Alstom's CAP technology with a compression system, and geologic storage system. To date, the CAP has met removal efficiency goals while producing a high quality CO_2 stream suitable for underground injection and storage. The geologic storage system receives the injected CO_2 while operating within the Class V Underground Injection Control permit conditions. Overall, the PVF is meeting its goals in validating the CO_2 capture and storage system and is serving as the design basis for the proposed project. AEP's proposed project is designed to demonstrate the commercial-scale operation of an integrated CCS project using Alstom's CAP process. The proposed project uses a similar process, albeit larger in size, to the PVF.

AEP initially identified 10 AEP-owned properties as candidates for CO_2 injection wells. AEP determined the five closest properties to be the most feasible, which would also minimize potential environmental impacts. AEP eliminated the remaining properties from further consideration as these properties were located much further from the Mountaineer Plant and presented significant challenges in securing ROW agreements and regulatory approvals in a timely manner. Likewise, the greater distance would add significant cost and time to the overall project, as well as create a greater potential for environmental impacts associated with additional stream, river, and wetland crossings.

2.2.4 Preliminary Project Option

Because Alstom's CAP technology may result in lower energy losses compared to other methods of post-combustion CO_2 capture, AEP did not consider other CO_2 capture technologies as part of their proposed project. However, AEP plans to complete a study to evaluate the feasibility of an amine-based CO_2 capture technology. AEP entered into a cooperative agreement with China Huaneng, through which AEP, China Huaneng, DOE, and the National Energy Administration of China will perform an initial evaluation of a post-combustion, advanced amine-based CO_2 capture technology. AEP will complete a study to evaluate the feasibility of the technology for potential use at supercritical coal-fired generating units with characteristics similar to the Mountaineer Plant. The feasibility study would evaluate technical issues related to design, performance, cost, and process integration. In addition, it would consider lessons learned from the testing and deployment of this technology by others for possible application to the Mountaineer CCS II Project. Results of the study may provide insight on key design and operating considerations, which could be used to evaluate development opportunities and associated risks in context with other potential CO_2 capture processes. In the event that AEP elects to move beyond the initial feasibility study and consider this as an alternative technology for this project, additional NEPA analysis could be needed to evaluate whether the potential impacts of this technology are significantly different from those of Alstom's technology.

2.2.5 Interim Actions

Interim actions, as defined by DOE's NEPA implementing regulations at 10 CFR 1021.104, are actions that are the subject of an ongoing EIS that DOE proposes to take before the ROD is issued and that are permissible under 40 CFR 1506.1 (Limitations on actions during the NEPA process). For an action to be considered permissible under 40 CFR 1506.1, it must not (1) have an adverse environmental impact; or (2) limit the choice of reasonable alternatives. DOE identified the action of providing financial support to AEP for the installation of a geologic characterization well at the Borrow Area as an allowable interim action. DOE determined that the well at this location would not have adverse environmental impacts or limit the choice of reasonable alternatives in accordance with 40 CFR 1506.1. During the course of this effort, if DOE learns of significant new information regarding its potential impacts (e.g., discovers endangered species or artifacts at the site), DOE would reconsider whether to proceed with the effort as an interim action. The data and information obtained from this well and other ongoing characterization activities will be used to refine project strategy.

2.3 DESCRIPTION OF APPLICANT'S PROPOSED PROJECT

2.3.1 Introduction

AEP's proposed project includes the design, construction, and operation of a commercial-scale CO_2 capture and geologic storage facility. The project would demonstrate the operation of an integrated CCS process at commercial scale on a coal-fired power plant. There are four primary components of the project:

1. **CO_2 Capture Facility** – The facility would capture CO_2 from a 235-MW flue gas slipstream from the existing 1,300-MW Mountaineer Plant. The facility would be designed with a target CO_2 capture rate of 90 percent and built on plant property.
2. **CO_2 Pipelines** – The captured CO_2 would be transported by pipeline (primarily underground) to AEP-owned properties located within 12 miles of the Mountaineer Plant.
3. **CO_2 Injection Wells** – The captured CO_2 would be injected into geologic saline formations located approximately 1.5 miles below the ground surface through injection wells located on two or more AEP-owned properties.
4. **CO_2 Storage Monitoring** – A geologic monitoring program would be established and operated in accordance with the required Underground Injection Control (UIC) permit.

Figure 2-1 presents an overall schematic of the existing PVF storage system, which includes features similar to the proposed project, albeit on a smaller scale. Each of these four project features is summarized in Table 2-1. Figure 2-2 shows the general location of the proposed project components.

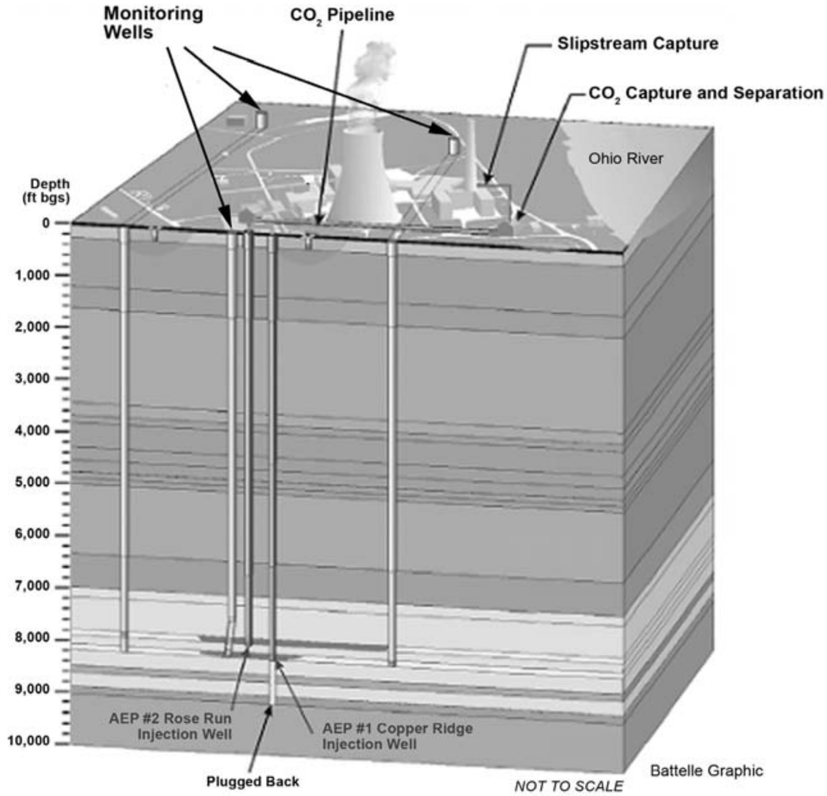


Figure 2-1. Schematic for Existing PVF System

The preferred locations of proposed project features, including access roads, pipelines, and injection well sites, are further addressed in this section. AEP developed and applied siting criteria to initially site project features. AEP would use these same siting criteria when selecting the monitoring well locations and in the event that a project feature would need to be relocated. These siting criteria include the following (to the extent practicable):

- **Avoid wetlands** – Project features would avoid wetland areas.
- **Avoid streams and floodplains** – Project features would avoid streams and floodplains and minimize the number of pipeline stream crossings.
- **Avoid sensitive habitats** – Project features would avoid areas identified as sensitive habitats.
- **Avoid cultural resources** – Project features would avoid areas containing known cultural resources.
- **Proximity to public roads** – Project features would use areas with ready access to public roads to minimize the creation of new access roads.
- **Topography** – Project features would use areas that are generally flat to minimize grading requirements and erosion potential.

Table 2-1. Proposed Mountaineer CCS II Project Features

Proposed Project Feature	Description	Characteristics
CO_2 Capture Facility	**Location:** A capture facility would be constructed at AEP's Mountaineer Plant. The facility would use the Alstom CAP to capture CO_2 from a 235-MW flue gas slipstream from the plant's 1,300-MW pulverized coal-fired electric generating unit.	**Facility Footprint:** 500 x 1000 feet (11.5 acres), located within a 33-acre area at the Mountaineer Plant.
CO_2 Pipelines	**Route:** Pipelines used to transport CO_2 from the Mountaineer Plant to the injection wells would be co-located within existing road and HVTL ROWs, to the extent possible. The length of the pipeline routes vary by corridor option as shown in Table 2-9. The range of pipeline lengths to the following injection well properties is: (1) Mountaineer Plant (0.13 mile) (2) Borrow Area (2.24 miles) (3) Eastern Sporn Tract (5.00 to 8.65 miles) (4) Jordan Tract (9.24 to 9.68 miles) (5) Western Sporn Tract (5.69 miles) **Operator:** AEP would own, operate, and maintain the CO_2 pipeline.	**Construction ROW Width:** 80-120 feet[a] **Permanent ROW Width:** 50 feet
CO_2 Injection Well Properties	**Location:** AEP anticipates that the project would require four to eight wells, located in pairs, at two to four of the following five properties: (1) Mountaineer Plant (33 acres) (2) Borrow Area (28 acres) (3) Eastern Sporn Tract (400 acres) (4) Jordan Tract (195 acres) (5) Western Sporn Tract (70 acres) **Quantity:** Each well would be designed to inject approximately 0.5 million metric tons of CO_2 per year. The total injection rate would be 1.5 million metric tpy.	**Construction Area:** Approximately 5 acres per injection well site **Well Depth:** Approximately 1.5 miles (7,920 feet) bgs **Operational Area:** 0.5 acre per site
Monitoring Wells	**Location:** The final approved UIC permit would dictate the final number of, and siting requirements for monitoring wells. Characterization wells could be converted into monitoring wells in the future. For this analysis, it is estimated that AEP would construct and use one to three monitoring wells per injection well, and that the monitoring wells would be placed within approximately 1,500 to 3,000 feet of the injection wells.	**Construction Area:** Approximately 5 acres per well site **Well Depth:** Dependent upon UIC permit requirements **Operational Area:** 0.5 acre per site (may be co-located at injection well sites)
Access Roads	**Location:** Access roads would be constructed from public roads to injection well sites.	**Construction Width:** 25 - 30 feet[a] **Permanent Width:** 12 - 15 feet

[a] The construction ROW at locations with steep side slopes may exceed 120 feet by up to 20 percent (i.e., up to 144 feet).

bgs = below ground surface; CAP = chilled ammonia process; CO_2 = carbon dioxide; HVTL = high voltage transmission line; MW = megawatt; tpy = tons per year; UIC = Underground Injection Control;

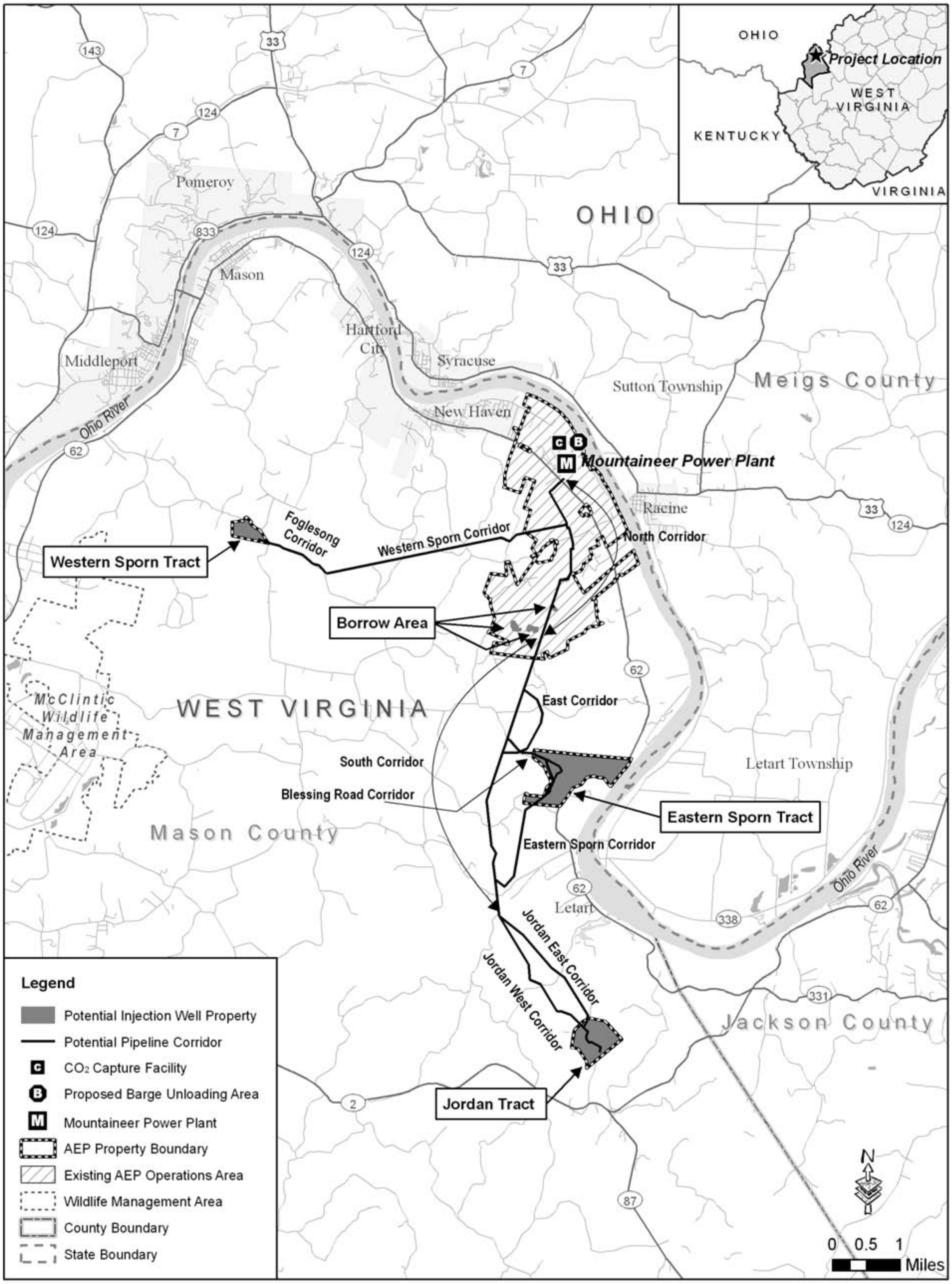


Figure 2-2. General Area Map

2.3.2 Organization of this Section

The following sections describe AEP's proposed Mountaineer CCS II Project and include detailed descriptions of the proposed project components:

- CO_2 capture facility (Section 2.3.3)
- CO_2 pipelines (Section 2.3.4)
- CO_2 injection wells (Section 2.3.5)
- CO_2 storage monitoring (Section 2.3.6)
- Decommissioning (Section 2.3.7)
- Measures to reduce potential impacts (Section 2.3.8)

2.3.3 CO_2 Capture Facility

The proposed project would install a CO_2 capture facility at AEP's existing Mountaineer Plant (see Figures 2-2 through 2-5). The facility would use Alstom's CAP technology to capture approximately 1.5 million metric tons of CO_2 annually based on a design target of 90 percent CO_2 reduction from a 235-MW flue gas slipstream of the 1,300-MW Mountaineer Power Plant. The captured CO_2 would be transported by pipeline to injection wells located up to approximately 12 miles from the plant.

2.3.3.1 Location and Background

The Mountaineer Plant, shown in Figures 2-2 and 2-3, is located on a 450-acre property in Mason County, West Virginia. Other AEP facilities located on the property include the Phillip Sporn Power Plant and the Little Broad Run Landfill, both of which are owned and operated by AEP. The portion of the property where the Mountaineer Plant is located is bounded to the west by State Route 62, to the east by the Ohio River, and to the south by AEP's Phillip Sporn Power Plant. Figure 2-2 shows the location of the Mountaineer Plant and the AEP property boundary. The town of New Haven, West Virginia, is located approximately 1 mile to the northwest (i.e., down-river). The plant occupies an industrial area located next to relatively undeveloped lands, with scattered residences and mining operations to the south and west. The CAP facility would have a footprint of approximately 500 feet by 1,000 feet (11.5 acres), located within a 33-acre area at the existing Mountaineer Plant (see Figure 2-5).

Figure 2-3. Mountaineer Plant

Figure 2-4. Mountaineer PVF

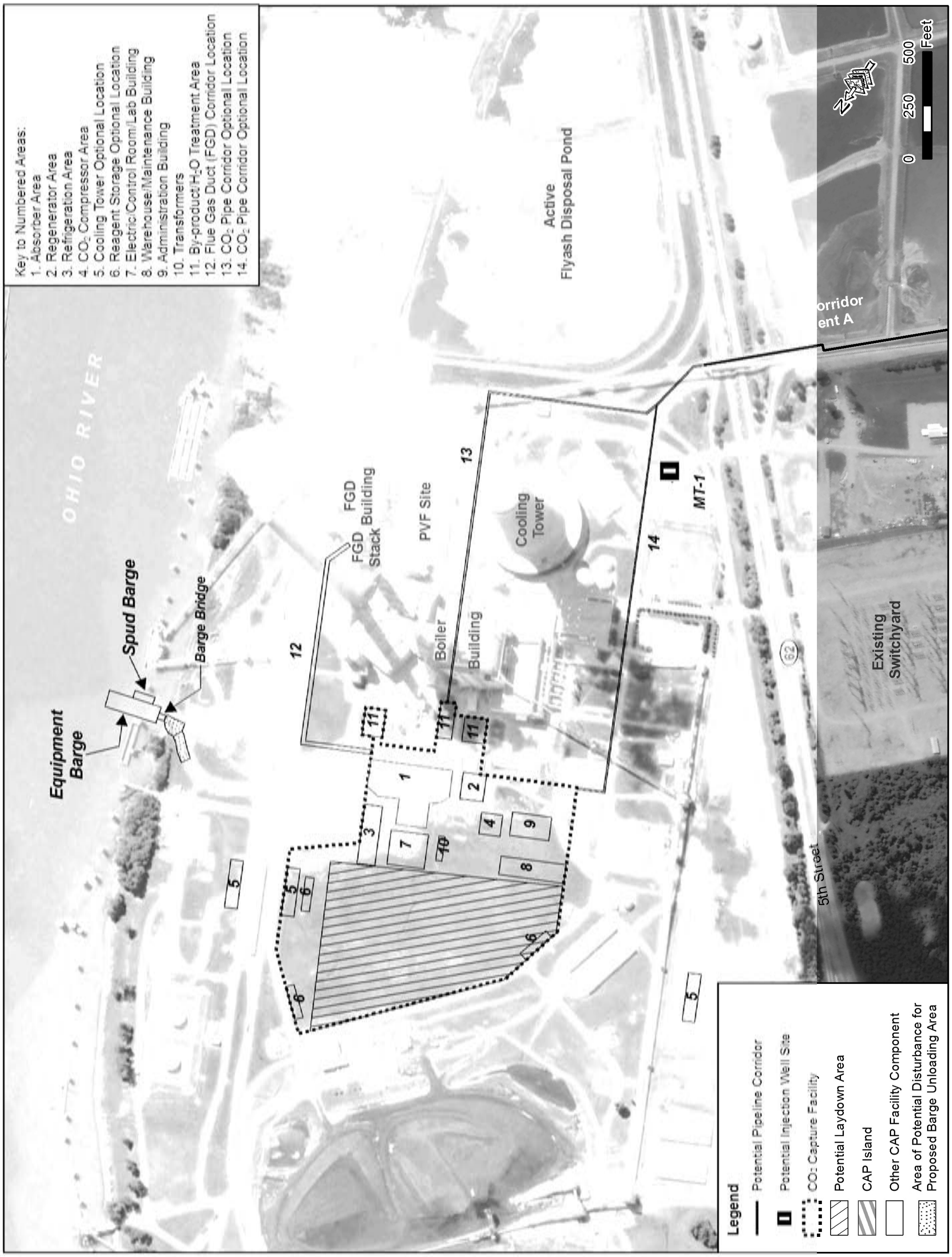


Figure 2-5. Proposed Location of the CO_2 Capture Facility

The existing Mountaineer Plant began commercial operation in 1980. The plant consists of a 1,300-MW pulverized coal-fired electric generating unit, a hyperbolic cooling tower, material handling and unloading facilities, and various ancillary facilities required to support plant operation. The plant uses (on average) approximately 10,000 tons of coal per day. Coal is delivered to the plant by barge (on the Ohio River), rail, and conveyors from a nearby coal mine located west of the site. The plant is equipped with air emissions control equipment, which includes: (1) an electrostatic precipitator for particulate control; (2) selective catalytic reduction for nitrogen oxides (NO_x) control; (3) a wet flue gas desulfurization (FGD) unit for sulfur dioxide (SO_2) control; and (4) a Trona injection system for sulfur trioxide (SO_3) control.

The existing Mountaineer Plant PVF (see Figures 2-4 and 2-5) uses Alstom's CAP system and treats approximately 20 MW of flue gas, or 1.5 percent of the total plant flue gas flow. The PVF started capturing CO_2 in September 2009 and initiated injection in October 2009. The PVF is designed to capture and store approximately 100,000 metric tons of CO_2 annually. Captured CO_2 from the PVF is injected via two onsite wells into two geologic formations (Rose Run and Copper Ridge) located approximately 1.5 miles below the plant site. The PVF also includes three deep monitoring wells used for monitoring geologic conditions and assessing the suitability of the geologic formations for future storage. The PVF would supply data to support the proposed project and would be shut down before the project initiates operation.

2.3.3.2 System Component Overview

The CO_2 capture system proposed for the Mountaineer CCS II Project would be similar to the Alstom CAP system currently operating at the Mountaineer Plant PVF, but approximately 12 times the scale. As with the PVF, the process would use an ammonia-based process solution to capture CO_2 and isolate it in a form suitable for geologic storage. The captured CO_2 stream would be cooled and compressed to a supercritical state for pipeline transport to the injection well sites. In general terms, supercritical CO_2 exhibits properties of both a gas and a liquid: supercritical CO_2 expands to fill its container like a gas, but with a density like that of a liquid. The process would be designed to remove approximately 90 percent of the CO_2 from the 235-MW slipstream of flue gas.

The existing Mountaineer Plant includes the space and infrastructure required to support the construction and operation of the CO_2 capture system. Major new equipment required would include absorbers, regenerators, pumps, heat exchangers, and refrigeration equipment. In addition, the project would require

The CAP would use ammonia-based reagents to remove CO_2 from the flue gas. The first step in the process is to cool the flue gas to temperatures necessary for CO_2 capture. The capture process involves CO_2 reacting with ammonia (NH_3) ions to form a solution containing ammonia-CO_2 salts. These reactions occur at relatively low temperatures and pressures within the absorption vessels. The solution of ammonia-CO_2 salts would then be pumped to a regeneration vessel. In the regeneration vessel, the solution is heated and the reactions are reversed, resulting in a high-purity stream of CO_2 and the regenerated reagent that is recycled back to the absorption vessel. The CO_2 stream would be scrubbed to remove excess ammonia, compressed, and then transported via pipeline to injection wells for geologic storage (See Figure 2-6).

> In a diluted form, **ammonia** (NH_3) is often used in commercial and household cleaning products.

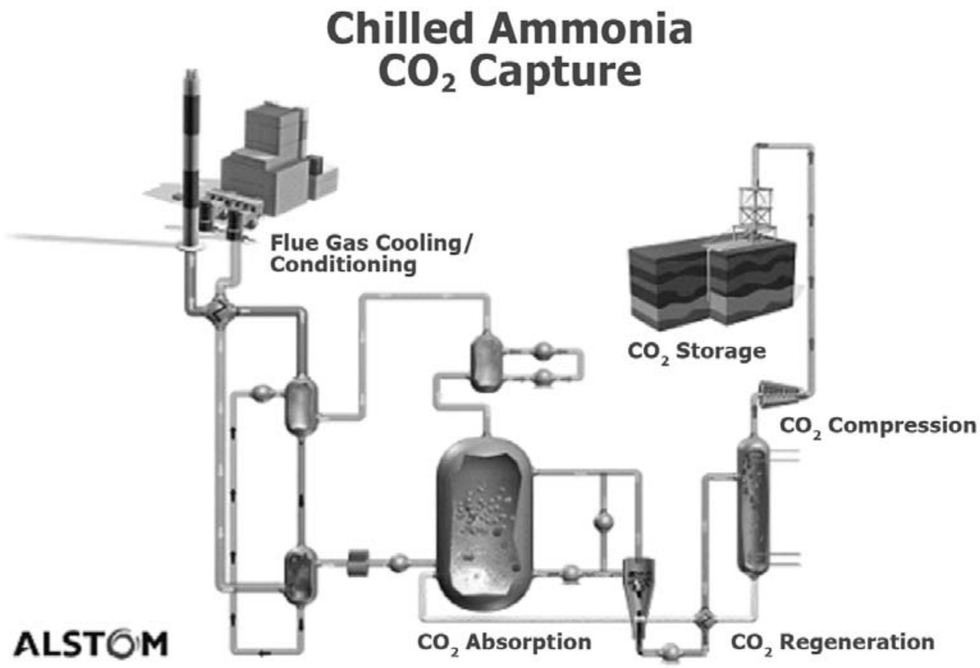


Figure 2-6. Alstom's Chilled Ammonia Process

The remainder of this section provides an expanded overview of the Alstom CAP system.

Flue Gas Cooling and Cleaning

The first step in the CAP is to cool and clean the flue gas, which enters the capture process at approximately 130 degrees Fahrenheit (°F) and contains residual amounts of SO_2, NO_x, and particulate matter (PM). The flue gas is taken from the plant's FGD system. The purpose of cooling the flue gas is to

- operate at a temperature that favors the formation of ammonium carbonate/bicarbonate;
- condense the moisture in the flue gas, which reduces the volumetric gas flow, increases the CO_2 concentration, and reduces the required size of CO_2 absorber vessels; and
- operate at a flue gas temperature that minimizes ammonia slip (unused ammonia in the downstream flue gas) from the absorption process.

During the cooling process, much of the water and most residual compounds (i.e., SO_2, SO_3, hydrogen chloride, hydrogen fluoride, and particulates) would be condensed out of the flue gas. The temperature of the circulating liquid would be reduced by the exchange of heat with water from a process cooling tower. The cooled circulating liquid is an ammonium sulfate solution that results from the reaction of ammonia and the incoming SO_2. A portion of the ammonium sulfate solution would be withdrawn from the process and treated for disposal or for commercial use as fertilizer. A sulfuric acid feed system would be provided for conditions when the incoming inlet SO_2 is not sufficiently high to react with ammonia in the flue gas leaving the CAP.

CO_2 Absorption

The second primary process step occurs in the CO_2 absorber, where CO_2 would be removed from the flue gas. The flue gas would enter the CO_2 absorber and flow through a chilled ammonia solution (i.e., ammonium carbonate/bicarbonate/carbamate). During this contact between the flue gas and the ammonia solution, the CO_2 would be absorbed by the ammonia solution before the treated flue gas exits the CO_2

absorber. The ammonia solution, which collects in the CO_2 absorber, contains the CO_2 that was absorbed from the flue gas (as ammonia-CO_2 based salts such as ammonium bicarbonate). The ammonia solution would then be transferred to the regeneration section. During the absorption process, a small amount of fresh ammonia (reagent) would be added to replenish ammonia losses from the CAP system and would be used to control the ratio of ammonia to CO_2 in the flue gas.

> Anhydrous ammonia is a concentrated form of ammonia with the term anhydrous referring to the absence of water. Anhydrous ammonia is more commonly used in industrial applications.

Water Wash and CO_2 and Ammonia Stripping

After the treated flue gas exits the CO_2 absorber, it would enter a water wash system to remove ammonia vapor and recover some of the refrigeration energy input into the system. As the flue gas enters the wash column, the ammonia in the flue gas would be removed as it contacts the water. As the wash water containing ammonia exits the column, it would then enter the stripper where the ammonia in the wash water would be removed. The recovered ammonia would exit the stripper and be returned to the CO_2 absorber as reagent. The clean water would be collected in the stripper, where it would then be re-used within the water wash column to remove additional ammonia. Energy for the stripper column would be provided by steam from the Mountaineer Plant. The treated flue gas would exit the top of the water wash column and flow to the exhaust stack.

Refrigeration System

The refrigeration system in the CAP would operate at two temperature levels, utilizing mechanical chillers to remove heat from the following parts of the process:

- Flue gas after it exits the cooling and cleaning step to further reduce the flue gas moisture and to lower the flue gas temperature
- Ammonia solution after it exits the CO_2 absorber to remove heat generated by the absorption of CO_2
- Water wash recirculation stream to reduce the amount of ammonia vapor in the flue gas

The refrigeration system would use anhydrous ammonia as the refrigerant. The chiller system refrigerant was selected based on its reliability, efficiency, cost, and compatibility with the mechanical chiller compressor system. Anhydrous ammonia, a common industrial refrigerant, is the most efficient refrigerant for the CAP chiller system, as it results in the lowest energy consumption. The heat transferred from the process streams to the chiller system refrigerant, would be dissipated from the system using a cooling tower or a series of evaporative coolers.

CO_2 Regeneration and Compression

The third primary step of the process would take the CO_2-rich ammonia solution from the absorber and direct it to the CO_2 regenerator where the CO_2 would be removed from the ammonia solution. The CO_2 regenerator would contain several sections of contacting equipment that enhance the transfer of CO_2 from the liquid phase to the gas phase. The CO_2 regenerator would use steam to remove the CO_2 from the ammonia solution. The stripped CO_2 and some residual water vapor would exit the CO_2 regenerator, and the ammonia solution would then be returned to the CO_2 absorber as reagent to capture additional CO_2. The CO_2 product stream would enter the CO_2 compressor, where its pressure would be increased up to 3,000 pounds per square inch (psi) for pipeline transport and geologic storage.

Amine-Based Capture System Feasibility Study

An amine-based capture system would be similar to Alstom's CAP in that it is a post-combustion chemical absorption technology that uses a solvent to extract CO_2 from the emission stream. The solvent can then be reused after the CO_2 is separated from the solvent. One of the primary differences between the two technologies is that an amine-based system would use an amine-based solvent, which would consist of an amine or amine mixture, such as monoethanolamine (MEA). Such solvents would also typically consist of additional chemicals (corrosion inhibitors) to prevent oxidation and corrosion and to improve the reaction speed. The specific composition of Huaneng China's solvent solution is unknown at this time as it is proprietary.

Amines are organic chemicals containing nitrogen that are derived from ammonia. Amine-based CO_2 capture is widely used to extract CO_2 from natural gas. However, there is still considerable uncertainty about the full-scale application of this technology to coal-fired power generating units. This uncertainty pertains, in part, to the lack of available information on the potential transformation of amines as a result of degradation during the CO_2 capture process. In addition, limited data are available on potential emissions from amine-based capture systems at this time (MacDowell, 2010).

2.3.3.3 Construction Phase

Construction of the proposed project would be expected to start in January 2013 and take approximately 32 months to complete. This 32-month period includes approximately 8 months of start-up and commissioning activities that would occur prior to commencing commercial operations to verify that all process systems achieve project requirements. Conventional construction methods would be used to build the project. Site preparation activities would begin with grading of the site. Following site preparation, other phases of construction would include the construction of administrative facilities, installation of piles and foundations, assembly of structural steel and building enclosures, and installation of mechanical and electrical systems.

Within the existing Mountaineer Plant property, up to 14 acres of land would be required for a temporary construction staging and lay-down area for materials and equipment. Construction materials and equipment could be delivered by trucks, rail, and barges. Construction truck traffic would access the plant site from State Route 62. AEP estimates that construction would generate approximately 20 to 90 deliveries per month by truck, with the most frequent deliveries (i.e., 60-90) per month occurring from October 2013 to October 2014. Construction could require, in total, approximately 4 rail-car deliveries and 30 barge deliveries during the height of construction.

The number of construction workers would vary during the construction period, ranging from 25 to 800 persons during the various phases of construction (including construction of the pipelines and injection wells). The largest demand for construction workers is expected to occur in the latter half of 2014, when the number of construction workers would consistently range from 600 to 800 persons during construction of the mechanical and electrical systems. Electricity and construction water needs would be supplied by the existing Mountaineer Plant for construction of the CO_2 capture facility. During the construction phase, AEP would provide potable water, portable toilets, and hand-wash stations for construction workers. In the later months of the construction phase, potable water and wastewater needs for construction of the CO_2 capture facility may be incorporated into the proposed project infrastructure.

Construction-related environmental concerns would be typical of those associated with a large industrial construction project and would primarily be related to air emissions, construction traffic, fugitive dust emissions from site disturbance, and stormwater runoff from construction areas. Best management practices (BMPs) would be implemented and all necessary permits would be obtained to minimize potential concerns and to comply with all regulatory requirements during construction.

AEP would receive the delivery of larger equipment via barge traffic during construction of the CO_2 capture facility by two methods. The first method would use an existing barge unloading platform to remove material from moored barges via a mobile crane. The second method represents an upgrade to the existing unloading capabilities and would allow for larger equipment to be unloaded through the use of a temporary mobile bridge that would span the area between the river bank and the parked barge. Barges would then be unloaded by driving the payload off of the barge to an existing haul road. The area proposed for bridge unloading is within the Mountaineer Plant property along the Ohio River (See Figure 2-5). The site is adjacent to the existing barge unloading platform, extending approximately 80 to 120 feet downstream. The barges would use existing mooring cells located in the river for the adjacent bulk material unloading facilities. The barges would not touch the river bottom.

Under the first method, AEP would use the existing platform and no modifications would be required. The second method would require site preparation (vegetation clearing and grading) along the river bank to support the placement of the mobile bridge. In addition a temporary "spud barge" would be used to stabilize the delivery barge for unloading for the bridge option, which would be anchored with H-piles that would be gravity dropped on the river bottom. The piles would be removed after work has been completed. No dredging would be required within the Ohio River. The construction footprint for the second method would involve approximately 0.28 acres of land disturbance. Approximately 0.15 acres of additional land grading may be required to support improvements to the haul road and the construction of a lay down area. Construction for the barge unloading area upgrades would take approximately 2 weeks and require 10 additional construction laborers.

Construction Safety Policies and Programs

Emergency services during construction would be coordinated with the local fire departments, police departments, paramedics, and hospitals. A first aid office would be provided onsite for minor incidents. Trained and certified health, safety, and environmental personnel would be onsite to respond to and coordinate emergencies. All temporary facilities would have fire extinguishers; fire protection would be provided in work areas where welding work would be performed. In addition, other AEP existing plans and policies regarding environmental safety and health will be updated as necessary to accommodate the proposed project.

Construction Waste

Construction of the proposed project would generate typical construction wastes. The predominant waste streams would include site clearing vegetation, soils, and debris; used lube oils; surplus materials; and empty containers. Surplus and waste materials would be recycled to the extent practicable. Solid wastes (i.e., garbage and rubbish) would be collected for disposal in a licensed offsite solid waste facility (i.e., a public landfill). Scrap and surplus materials and used lube oils would be recycled or reused to the maximum practicable extent. Temporary sanitary facilities (i.e., portable toilets and hand-wash stations) would be placed in appropriate locations at the construction sites for use by construction workers. These self-contained portable units would be serviced regularly and the wastes would be collected and hauled to permitted sewage treatment facilities by licensed waste transporters.

AEP would ultimately be responsible for the proper handling and disposal of construction wastes. However, construction contractors and their employees would be responsible for minimizing the amount of waste produced by construction activities. These contractors would be expected to fully cooperate with project procedures and regulatory requirements for waste minimization and the proper handling, storage, and disposal of hazardous and non-hazardous wastes.

2.3.3.4 Operation Phase

The project demonstration phase would last for 46 months per the terms and conditions of the Cooperative Agreement between DOE and AEP. AEP would determine whether to continue operating the CCS facility after the completion of the demonstration phase. A variety of factors could affect the possible long-term operation of the CCS facility, including potential future CO_2 legislation and regulations, process performance, and economics. For the purposes of this EIS, DOE assumed the CCS facility would continue to operate for 20 years.

Operational Labor

The existing Mountaineer Plant currently employs 195 people (i.e., 110 for operations and 85 for maintenance) and operates 24 hours per day, 7 days per week, with employees working in shifts. The project would require an increase of approximately 38 full-time employees divided among shifts (i.e., an increase of approximately 19 percent over current conditions). The employees would include 26 staff for operations (i.e., 16 operators, 4 supervisors, 2 process leads, 1 process planner, 2 laboratory technicians, and 1 clerical person) and 12 staff for maintenance. All new staff would be based at the Mountaineer Plant.

Health and Safety Policies and Programs

AEP's existing Environmental, Health, and Safety Policy (EHS Policy) directs all persons and entities operating and maintaining the Mountaineer Plant on its behalf to act in a manner protective of human health, the environment, and property while complying with all applicable environmental laws and regulations. The EHS Policy would apply to the facilities and personnel associated with the project.

AEP would also update its existing Environmental Management System (EMS) at the Mountaineer Plant to include the proposed project. The EMS implements the EHS Policy within the context of federal, state, and local laws and regulations, along with specific permits and agreements that define AEP's environmental requirements. The goal of the EMS is to efficiently execute all plant activities with no deficiencies in environmental compliance.

The storage and handling of toxic or flammable materials would be conducted in compliance with EPA and Occupational Safety and Health Administration (OSHA) regulations and the National Fire Protection Association's "Guide on Hazardous Materials" (NFPA, 2010). The plant's Spill Prevention, Control, and Countermeasures (SPCC) Plan would be updated to encompass the project in compliance with federal and state regulations. Existing worker safety programs would continue to ensure that workers are aware and knowledgeable about spill containment procedures and related health and environmental protection policies.

Resource Requirements (Process Inputs)

Process Chemicals

During operation of the project, process related chemicals would be transported to the Mountaineer Plant either by truck or rail. The amount of chemicals stored at the Mountaineer Plant would be determined by the rates of consumption, customary delivery volumes available from suppliers, and the reliability of supply. In addition to regulatory requirements, AEP would follow the chemical suppliers' recommendations and procedures in storing and handling all chemicals.

The CAP technology requires the use and storage of reagents and refrigerants, some of which are considered hazardous substances. The reagent for the CAP would either be anhydrous ammonia or an aqueous ammonia solution. The refrigerant used would be anhydrous ammonia, which AEP chose after an analysis of various options (including other refrigerants such as R-134a and R-410a) considering factors such as performance, efficiency, toxicity, and economics. The CAP would also use sulfuric acid. Table 2-2 lists chemicals that would be used by and stored at the Mountaineer Plant to support the project.

AEP would design and engineer the chemical feed storage systems to include adequate valving, interlocks, and safety systems (i.e., fogging, foaming, secondary containment, berms, spill prevention, instrumentation, ambient monitoring systems, alarms, etc.) to ensure the safe operation, maintenance, and reliability of the equipment for the life of its use. AEP would consult with the design engineer and potential suppliers of anhydrous ammonia to develop the design for the ammonia storage and handling systems. AEP would also complete a preliminary hazard analysis early in the design process to review the conceptual design prior to the development of detailed engineering and design. Based on a review of hazards and in accordance with all regulatory requirements, AEP would implement the following precautions:

- Install tanks/vessels on concrete foundations with appropriate secondary containment.
- Locate ammonia reagent and sulfuric acid storage tanks outdoors with secondary containment for spills around the tank and in defined unloading areas.
- Provide nearby safety showers and eyewash stations.

- Design and install all process fluid tanks/vessels and associated equipment (i.e., pumps, piping, valves, etc.) per industry standards and codes.
- Include process drains, sumps, etc., to capture spills, leaks, and washdown of the area and equipment, consistent with West Virginia groundwater protection rules and any other applicable state or federal rule or standard pertaining to spill prevention.
- Ensure normal operation of the CAP would maintain compliance with the National Pollutant Discharge Elimination System (NPDES) permit for the facility.

Currently, each year the Mountaineer Plant receives approximately: 7,500 deliveries by large trucks and semi-trailers; 3,000 deliveries of coal and limestone by barges; and 400 deliveries by rail cars. Implementation of the project would generate additional traffic to the facility during operation. Chemicals delivered to the CO_2 capture facility (i.e., ammonia and sulfuric acid) would most likely be delivered by truck; however, deliveries may also occur by rail. Table 2-3 presents the estimated annual shipments by either truck or rail for the various chemicals proposed for use at the CO_2 capture facility at the Mountaineer Plant.

Table 2-2. Estimated CAP Chemical Inputs and Storage Quantities

Input	Usage Rate	Storage Inventory	Storage Type
Reagent			
Option 1: Anhydrous Ammonia System			
100-percent anhydrous ammonia system	650 to 850 lbs/hr	28,739 gallons (146,569 lbs) (in closed system)	Two 17,000-gallon (carbon steel) ASTs outdoors
Option 2: Aqueous Ammonia System			
29-percent aqueous ammonia	2,500 lbs/hr	54,308 gallons (396,448 lbs)	Two 28,000 gallon (carbon steel) ASTs outdoors
100-percent anhydrous ammonia for startup or upset conditions	Varies based on potential upsets; normally no usage	28,739 gallons (146,569 lbs)	Two 17,000 gallon (carbon steel) ASTs outdoors
Refrigerant			
Anhydrous ammonia	80,000 lbs/yr	157,000 gallons (800,000 lbs)	800,000 lbs in closed refrigeration system (largest single vessel approx. 250,000 lbs)
Other Process Chemicals			
Sulfuric acid	750 to 900 lbs/hr (93 percent by weight)	45,000 gallons (675,000 lbs)	45,000-gallon AST, outdoors
Ammonium sulfate (15-35 percent by weight)	NA	150,000 gallons	Four 37,500-gallon or two 75,000-gallon (carbon steel) ASTs outdoors

AST = aboveground storage tank; CAP = chilled ammonia process; lbs/hr = pounds per hour; NA = not applicable

Table 2-3. Estimated Material and Waste Transportation

Chemical	Truck Shipments[b]	Rail-car Shipments[b]
Materials		
Anhydrous ammonia[a]	180 per year	40 per year
Aqueous ammonia[c]	430 per year	100 per year
Sulfuric acid	120 per year	40 per year
Wastes or By-Products		
Ammonium sulfate	730 per year	NA

[a] Estimates include additional reagent required for startup or upset conditions or deliveries for refrigerants (up to 80,000 pounds per year; approximately two additional truck shipments per year).
[b] Delivery amounts shown would be totals for either truck shipments or for rail shipments, and are not additive.
[c] Representative of traffic to support option to use 29-percent aqueous ammonia as reagent.
NA = not applicable

An amine-based capture technology typically requires the use and storage of an aqueous amine solution and corrosion inhibitors. It would not likely require the use and storage of anhydrous ammonia. In general, amines are caustic, corrosive, and smell similar to ammonia. The quantities of process chemicals used in an amine-based capture system are unknown at this time. The feasibility study would evaluate this and other issues in more detail. Available literature indicates that amine solutions would typically be consumed at rates between 1 to 4 pounds (0.35 to 2.0 kilograms) per metric ton of CO_2 captured (Bailey, 2005). At these rates, a system capturing 1.5 million metric tons per year would require approximately 600 to 3,000 tons (540 to 2,700 metric tons) of amines for the process and for replacement of amounts lost through emissions and degradation.

Plant Flue Gas (CAP Input)

Characteristics of the flue gas that would be treated are presented in Table 2-4. During flue gas cooling, moisture, along with other constituents (e.g., SO_2, particulates, etc.) present in the flue gas, would be condensed and removed before being sent to the WWTP.

Process Water

Process water is supplied to the Mountaineer Plant from the existing river water makeup system via the Ohio River. The Mountaineer Plant consumes approximately 18.74 million gallons per day (mgd) of process water. A portion of this process water (0.07 mgd) is treated at the plant's demineralized water system before use as process water.

The proposed CAP facility would require an increase of approximately 1.9 mgd of process water, approximately 10 percent over the existing demand for the plant. This additional volume would be supplied from the Mountaineer Plant's existing water system. No new water intake structures or additional demineralized water capacity would be required.

Utilities

The plant operates a 1,300-MW pulverized coal-fired electric generating unit. The current average full-load auxiliary power demand at the Mountaineer Plant is approximately 96 MW. The additional auxiliary power demand for operation of the CO_2 capture facility would range from approximately 50 to 80 MW, which could be accommodated by the plant.

Table 2-4. Nominal Characteristics of Existing Mountaineer Plant Flue Gas (CAP Input)

Parameters		Value
Temperature		133°F
Pressure		14.5 psia
Flow Rate		631,863 scfm[a]
Components	NH_3	2.0 ppmv
	CO_2	105,993 ppmv
	N_2	680,900 ppmv
	NO_x	100 ppmv
	O_2	54,900 ppmv
	Particulates[a]	125 lbs/hr
	SO_2	80 ppmv
	SO_3	25 ppmv

[a] Estimated as 18 percent of annual total emissions from the existing Mountaineer Plant (235-MW slipstream from 1,300-MW power plant).

[b] The values presented represent nominal values from the conceptual design.

CAP = chilled ammonia process; CO_2 = carbon dioxide; °F = degrees Fahrenheit; lbs/hr = pounds per hour; MW = megawatt; N_2 = nitrogen; NH_3 = ammonia; NO_x = nitrogen oxides; O_2 = oxygen; ppmv = parts per million by volume; psia = pounds per square inch absolute (including atmospheric pressure); scfm = standard cubic feet per minute; SO_2 = sulfur dioxide; SO_3 = sulfur trioxide

The New Haven Municipal Water and Sewer Department provides potable water to the Mountaineer Plant at an average rate of approximately 11,088 gallons per day (gpd). The potable water demand for the CO_2 capture facility would be limited to the needs of a daily workforce of 38 additional employees. Based on an estimated usage rate of 30 gpd per person of potable water for consumption and sanitary needs, the daily demand would increase by approximately 1,140 gpd, an increase of approximately 10 percent. Refer to Table 2.5 for more information.

By-Products, Discharges, and Wastes (Process Outputs)

CO_2 Stream

Characteristics of the CO_2 product stream are presented in Table 2-6. The pressure of the CO_2 product stream leaving the capture process would minimize the need for additional CO_2 compression equipment and related operating costs.

Industrial Wastewater

Currently, Mountaineer Plant effluent streams containing raw materials, chemicals, oil, or process water are directed for treatment at the plant's WWTP prior to discharge (ultimately to the Ohio River). The Mountaineer Plant currently discharges treated wastewater to surface waters under an NPDES permit. The Mountaineer Plant discharges noncontact cooling water and treated process water through 20 different outlets located throughout the plant site to the Ohio River, Little Broad Creek, and an unnamed tributary of the Ohio River (WVDEP, 2006a).

Table 2-5. Utility Requirements for Existing Mountaineer Plant and Proposed CO_2 Capture Facility

Utility	Existing Plant	Proposed CO_2 Capture Facility		Utility Provider
		Construction	Operation	
Auxiliary Power	96 MW (full-load auxiliary power demand)	Negligible	50 to 80 MW[a]	Mountaineer Plant. Capacity: 1,300 MW
Potable Water	11,088 gpd	1,500 to 45,600 gpd[b]	2,200 gpd[c]	New Haven Water Facility
Process Water	18,740,000 gpd	• 2,500,000 gallons over 32-month construction phase (for dust control and general washdown) • 600,000 gallons of demineralized water for hydrotesting and system startup	• 1,800,000 gpd makeup water rate • 72,000 gpd demineralized water	• Supplied by Mountaineer's existing river water makeup system • Mountaineer Plant demineralized water system
Sanitary Wastewater	11,770 gpd	1,500 to 48,000 gpd[b,d]	2,300 gpd[c]	New Haven Sanitary Waste Facility

[a] Represents both steam and electrical demand.
[b] Based on 25 to 800 construction workers.
[c] Based on 38 permanent employees.
[d] Sanitary wastewater during construction would be handled through either the public utility or portable restrooms, estimated as follows: waste from between 50 to 100 personnel would be directed to the NHSWF, the remainder of the wastewater would be disposed of offsite through contracts with portable restroom providers. The portable units would be collected and hauled to sewage treatment facilities in the area by licensed waste transporters. As a worst-case scenario, it is assumed that the NHSWF would ultimately receive the wastewater from the portable restrooms.

AEP = American Electric Power Service Corporation; CO_2 = carbon dioxide; gpd = gallons per day; MW = megawatt; NHSWF = New Haven Sanitary Waste Facility

Table 2-6. Estimated Characteristics of Product Stream Exiting the CAP for Geologic Storage

Parameters		Value
Temperature		90 to 110°F
Pressure		1,500 to 3,000 psi
Total Mass Rate		445,498 lbs/hr
Volumetric Rate		60,433 scfm
Components	NH_3	< 50 ppmv
	CO_2	$\geq$ 99.5 percent by volume
	N_2	< 100 ppmv
	H_2O	< 3,000 ppmv

CAP = chilled ammonia process; CO_2 = carbon dioxide; °F = degrees Fahrenheit; lbs/hr = pounds per hour; H_2O = water; N_2 = nitrogen; NH_3 = ammonia; ppmv = parts per million by volume; psi = pounds per square inch; scfm = standard cubic feet per minute

The Mountaineer Plant generates approximately 17.3 mgd of industrial wastewater (see Table 2-7). Industrial wastewater is treated by the onsite WWTP prior to discharge to the Ohio River. The treatment process generates 0.14 mgd of sludge, which is disposed of at AEP's Little Broad Run Landfill.

Table 2-7. Industrial Wastewater Estimates for Mountaineer Plant and Proposed CAP Facility

Industrial Wastewater	Existing Plant	Proposed CO_2 Capture Facility		Utility Provider
		Construction	Operation	
Industrial Wastewater	17,300,000 gpd	NA	• Off-spec ammonium sulfate solution (15-35 percent by weight): quantity would vary[a] • Wastewater from the flue gas cooling/cleaning process; quantity varies • Absorber building sump wastewater; quantity varies	• Onsite treatment system to evaporate water and produce concentrated dry ammonium sulfate product[b] • Onsite wastewater treatment or reuse by the Plant[b]

[a] On-spec ammonium sulfate is a marketable by-product.

[b] The project may use the existing wastewater treatment capacity at the plant or a new WWTP would be built for the proposed project, and treated water discharged via existing plant outfall.

CAP = chilled ammonia process; CO_2 = carbon dioxide; gpd = gallons per day; NA = not applicable

The current onsite WWTP may have sufficient capacity to handle additional process flow from the CAP facility. However, should the existing system prove incapable of providing the necessary capacity, a new industrial WWTP would be constructed to treat effluent streams from the CO_2 capture facility. The WWTP would be constructed within the footprint of the CO_2 capture facility. Effluent from the new WWTP would be sent to the existing plant's permitted outfall.

Other wastewater from the CO_2 capture facility may include purge streams (i.e., from the flue gas cooling and ammonia stripping processes), cooling tower blowdown, potential process leaks or spills, and maintenance activities (e.g., washdown). Wastewater from these sources would be managed by

- reuse in the CAP;
- reuse in other Mountaineer Plant processes (e.g., FGD system);
- monitoring, treatment, and release to a permitted outfall; or
- collection for offsite disposal.

By-Products

The by-product stream from the CAP facility under normal operations would consist of an ammonium sulfate solution (15-35 percent by weight). There is potential for this by-product stream to be sold for agricultural use in liquid or concentrated dry solid form. If the market warrants, AEP would provide an onsite treatment system to evaporate water from the solution to produce a concentrated dry ammonium sulfate product at a maximum rate of 2,500 pounds per hour (lbs/hr). The dry product would be stored onsite and transported by truck to regional agricultural product suppliers. If the market is not available, the by-product would be processed with calcium oxide (lime) to form gypsum and would be sent to the AEP Little Broad Run Landfill, located onsite.

Solid Waste

The potential exists for infrequent generation of off-specification by-product waste from the proposed CO_2 capture facility. Any by-product of insufficient quality to have a marketable value would be considered off-specification and would be treated as a waste. Long-term maintenance of process equipment (e.g., absorber vessels, regenerator, stripping systems, etc.) to replace packing and system components is expected. The material removed and/or waste generated as part of this required maintenance is not expected to be hazardous. Routine maintenance of process components (e.g., pumps, valves, etc.) is not expected to generate significant amounts of waste. Any waste generated would be properly managed and disposed of at a suitable waste disposal facility.

In the event of a process malfunction, maintenance may be required. These events could produce a waste product not considered in the maintenance scenarios above; such wastes may or may not be hazardous. These events would be rare, treated on a case-by-case basis, and not expected during normal operation. The waste material generated as a result of these activities would be handled according to applicable laws and regulations, plant operations and maintenance standards, risk management plans (RMP), Material Safety Data Sheets recommendations, and other industry or agency standards for proper handling and disposal. These types of emergency events would be addressed in a Hazards and Operability study prior to operations, such that potential problems and risks are identified, employee awareness is raised, mitigations of risk are implemented, and emergency procedures are effective.

An amine-based capture system would have the potential to generate amine wastes. The composition of amine waste would depend on the specific amine solvent solution used, but would typically include spent amine solvent, amine degradation products, and corrosion inhibitors (Thitakamol, 2007). A typical CO_2 capture process using an amine-based solvent with a capacity to capture 1 million metric tons of CO_2 annually might be expected to generate 330 to 3,300 tons (300 to 3,000 metric tons) of amine waste annually (Bellona, 2009). There is still considerable uncertainty about the degradation products that would result from a large-scale amine-based capture system. Available literature indicates that potential degradation products could be determined to be hazardous waste due to corrosivity and toxicity. If so, such wastes would have to be transported to a licensed hazardous waste disposal facility, and would have to be properly managed. The feasibility study would evaluate this issue in more detail.

Air Emissions

The proposed CAP system would be designed to achieve a 90 percent CO_2 capture efficiency during steady-state operations, which equates to approximately 1.5 million metric tons per year (tpy) of CO_2 emissions reduction. While the CAP may offer the additional benefit of reducing other residual emissions, these reductions are ancillary and not the focus or claim of the CAP process. The CAP is not expected to increase the emission rates of any regulated emissions. Therefore, the Mountaineer Plant would be expected to continue operating within the limits of its existing Title V air permit.[1] The treated flue gas exiting the CAP would be returned to the existing Mountaineer Plant stack for discharge. Table 2-8 summarizes the estimated concentrations of the treated flue gas exiting the CAP facility.

Truck and rail transport to and from the CO_2 capture facility would generate combustion-related emissions, as well as fugitive dust emissions. Two new cooling towers would be required for the project, which would have the potential to generate particulate emissions. These emissions are expected to be minor or de minimis in quantity, especially since a drift elimination system would be used. Please refer to Section 3.1, Air Quality and Climate, for further discussion on potential emissions from the project.

An amine-based capture system would have the potential to emit amines to the atmosphere. The amount and characteristics of amines that could be emitted depends on the size of the gas stream from which CO_2 is being captured and other factors. Annual amine emissions for a large-scale amine-based CO_2 capture system might be in the range of 44 to 176 tons (40 to 160 metric tons) for a system capturing approximately one million metric tons of CO_2 annually (Bellona, 2009). The feasibility study would evaluate this issue in more detail.

2.3.4 CO_2 Pipelines

The project would transport captured CO_2 via pipelines to injection wells located within 12 miles of the Mountaineer Plant. The ultimate configuration of the pipeline routes would depend on which potential

[1] The Mountaineer Plant's current Title V permit does not contain emission limits for ammonia. The proposed CO_2 capture facility would emit approximately 10 parts per million or less of ammonia, which is approximately equal to, or less than, 14 pounds per hour.

injection well sites would be used. As described in Section 2.3.5.1, AEP is in the process of determining the combination of sites that would be used.

Table 2-8. Estimated Characteristics of Treated Flue Gas Exiting the Capture Facility for Return to the Existing Mountaineer Plant Stack

Parameter		Value
Temperature		114°F
Pressure		14.7 psia[a]
Flow Rate		528,975 scfm
Components	NH_3	< 10 ppmv
	CO_2	13,000 ppmv
	N_2	813,000 ppmv
	NO_x	< 100 ppmv
	O_2	67,000 ppmv
	Particulates	< 50 lbs/hr
	SO_2	< 20 ppmv
	SO_3	< 10 ppmv

[a] Maximum quantities.

CO_2 = carbon dioxide; °F = degrees Fahrenheit; lbs/hr = pounds per hour; N_2 = nitrogen; NH_3 = ammonia; NO_x = nitrogen oxides; O_2 = oxygen; ppmv = parts per million by volume; psia = pounds per square inch absolute (including atmospheric pressure); scfm = standard cubic feet per minute; SO_2 = sulfur dioxide; SO_3 = sulfur trioxide.

2.3.4.1 Location and Background

Lands between the Mountaineer Plant and some of the injection well properties are not entirely owned by AEP; therefore, AEP would establish a pipeline corridor and obtain legal ROWs, setbacks, and easements as needed. AEP identified pipeline corridors to each of the injection well sites (see Figure 2-7 and Table 2-9). AEP's pipeline would follow existing, previously disturbed AEP electrical transmission line corridors to the extent possible. This would reduce the level of potential environmental and socioeconomic impacts that could result from establishing new ROWs. However, existing landowner agreements would need to be re-visited. General descriptions of potential pipeline corridors are provided below:

- **North Corridor** (2.69 miles) - Beginning at the Mountaineer Plant property, extending generally southward before terminating in the vicinity of the Borrow Areas. The North Corridor is located entirely within AEP-owned property and lies almost entirely within, or immediately adjacent to, an existing transmission ROW. Much of the land traversed by the North Corridor is currently developed or has been previously disturbed.
- **South Corridor** (4.36 miles) - Begins at the southern end of the North Corridor and extends southward to Gill Road (County Route 20). The majority of the South Corridor lies within an existing transmission ROW. The only exception is a small section of the corridor located between County Route 12/8 and County Route 15, in which the proposed corridors briefly bends toward the east into wooded areas. A majority of the northernmost one-third of the South Corridor, north of Blessing Road, crosses through agricultural land and cattle pasture.
- **Blessing Road Corridor** (0.67 miles) - Loosely follows along Blessing Road from the South Corridor eastward to the Eastern Sporn property. The Blessing Road Corridor, which does not follow an existing transmission ROW, also crosses through a portion of the East Corridor (described below). The Blessing Road Corridor is located on the north side of Blessing Road and

crosses through some privately-owned properties and meadows; only two small segments of this corridor traverse through wooded areas.

- **East Corridor** (1.42 miles) - Approximately 1.42 miles in length, it does not follow an existing transmission ROW. The corridor begins near the northern end of the South Corridor. It extends eastward, turns south, and then bends back to the west, reconnecting with the South Corridor just south of Blessing Road. The northernmost approximately one-fourth of the East Corridor crosses through cattle pasture, while the southernmost approximately one-fourth crosses through meadow and one privately-owned property. In between, the East Corridor predominantly crosses through wooded areas.
- **Eastern Sporn Corridor** (1.72 miles) - Generally runs in a north-south direction, beginning at a portion of the South Corridor and terminating at the Eastern Sporn property. The Eastern Sporn Corridor lies completely within or immediately adjacent to existing transmission ROWs for its entire length.
- **Jordan West Corridor** (2.20 miles) - Extends southward from the southern end of the South Corridor to the Jordan property. It predominantly lies within an existing transmission ROW, with the exception of two short sections of the corridor, that traverse through wooded areas.
- **Jordan East Corridor** (2.19 miles) - Extends southward from the southern end of the South Corridor to the Jordan property. The Jordan East Corridor meets the South Corridor at the same location as the Jordan West Corridor. However, the Jordan East Corridor takes a more easterly route towards the south, following an existing transmission ROW for nearly its entire length.
- **Western Sporn Corridor** (3.68 miles) - Runs in an east-west direction, extending westward from the North Corridor on AEP property to Dave Foglesong Road (County Route 3/3). This corridor traverses along and within the north side of an existing double transmission ROW. The corridor runs through or adjacent to several open fields/meadows, and a corn field.
- **Foglesong Corridor** (1.16 miles) - The Foglesong Corridor extends from the terminus of the Western Sporn Corridor westward to the Western Sporn property. The corridor follows along and adjacent to the north side of Dave Foglesong Road (County Route 3/3).

Pipeline corridors have been divided into segments to facilitate the alternative routing options. These segments intersect with other corridors or injection well sites. For example, the North Corridor is comprised of three corridor segments. The first segment (North Corridor Segment A) starts at the Mountaineer Plant and ends at the intersection of the North Corridor and Western Sporn Corridor, while the second (North Corridor Segment B) continues to Injection Well Site BA-1 at the Borrow Area. The third segment (North Corridor Segment C) continues from Injection Well Site BA-1 to the end of the corridor where it meets the South Corridor. The corridors and corridor segments are labeled on Figure 2-7. The injection well properties and possible injection well sites are discussed in Section 2.3.5 and also labeled in Figure 2-7.

The pipeline corridors that have been identified by AEP allow for pipeline routes from the Mountaineer Plant to the potential injection well properties and alternative routes to both the Eastern Sporn Tract and Jordan Tract. Each alternative route consists of a different set of pipeline corridor segments. There are four alternative route options to the Eastern Sporn and Jordan properties. Table 2-9 details the corridor segments that comprise each of the routes and alternative routes to each injection well site.

Pipeline routing on the properties is not included in Table 2-9 as it would depend on the specific location of the injection well site. The final length of pipeline from the end of the pipeline corridor to the injection well is called a pipeline spur.

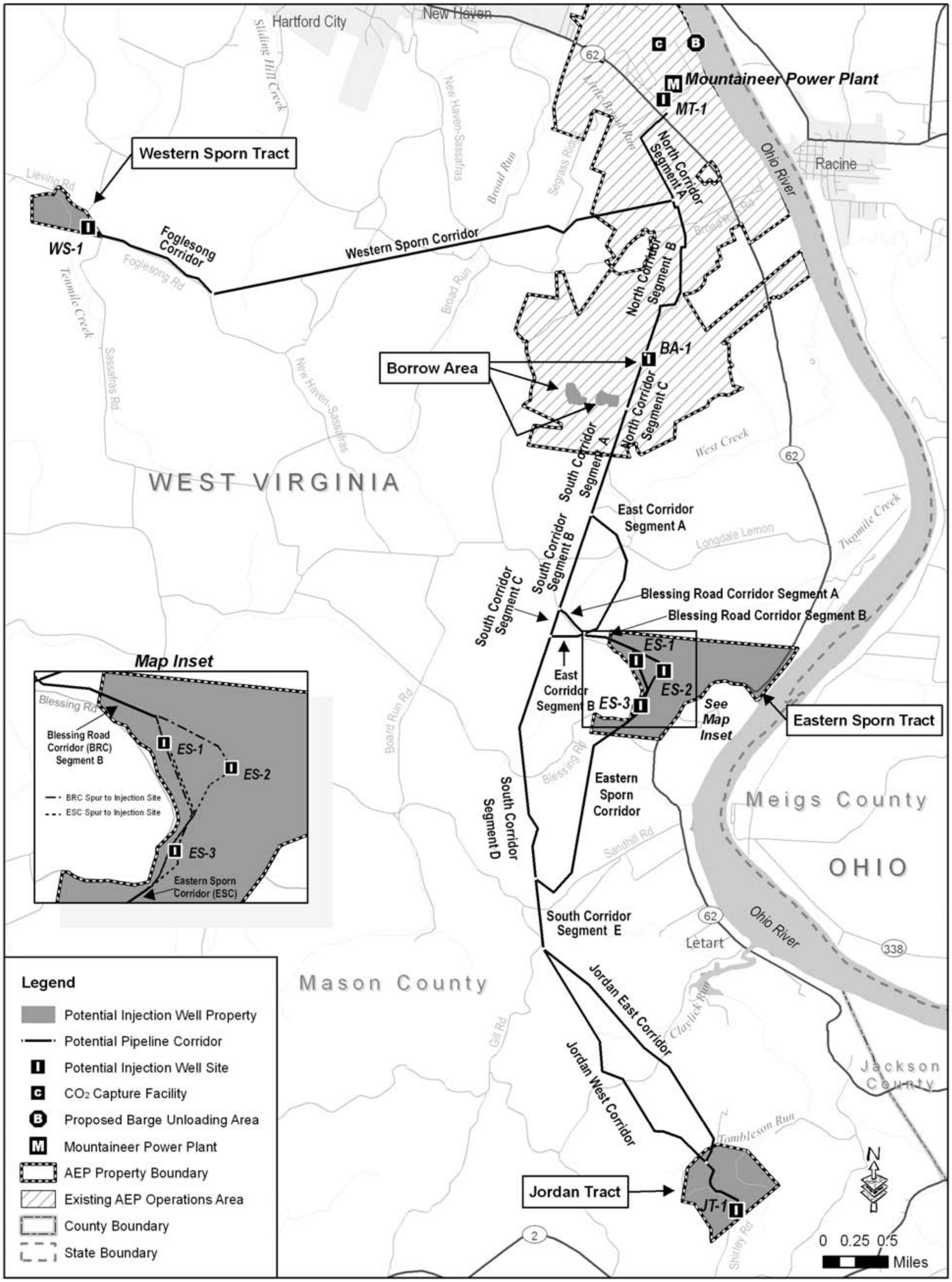


Figure 2-7. Potential CO_2 Pipeline Corridors

Table 2-9. Potential CO_2 Pipeline Corridors and Alternative Routes

Potential Injection Well Property	Route or Alternative Route	Route Length (miles)	Segments That Comprise Route	Segment Length (miles)
Mountaineer Plant	Plant Routing	0.13	NA	0.13
Borrow Area	Borrow Area Route	2.24	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
Eastern Sporn Tract	Eastern Sporn Route 1	5.00	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			South Corridor Segment B	0.77
			Blessing Road Corridor Segment A	0.27
			Blessing Road Corridor Segment B	0.40
	Eastern Sporn Route 2	8.22	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			South Corridor Segment B	0.77
			South Corridor Segment C	0.22
			South Corridor Segment D	1.95
			Eastern Sporn Corridor	1.72
	Eastern Sporn Route 3	5.11	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			East Corridor Segment A	1.15
			Blessing Road Corridor Segment B	0.40
	Eastern Sporn Route 4	8.65	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			East Corridor Segment A	1.15
			East Corridor Segment B	0.27
			South Corridor Segment D	1.95
			Eastern Sporn Corridor	1.72

Table 2-9. Potential CO_2 Pipeline Corridors and Alternative Routes *(Continued)*

Potential Injection Well Property	Route or Alternative Route	Route Length (miles)	Segments That Comprise Route	Segment Length (miles)
Jordan Tract	Jordan Route 1	9.25	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			South Corridor Segment B	0.77
			South Corridor Segment C	0.22
			South Corridor Segment D	1.95
			South Corridor Segment E	0.55
			Jordan West Corridor	2.20
	Jordan Route 2	9.24	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			South Corridor Segment B	0.77
			South Corridor Segment C	0.22
			South Corridor Segment D	1.95
			South Corridor Segment E	0.55
			Jordan East Corridor	2.19
	Jordan Route 3	9.68	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			East Corridor Segment A	1.15
			East Corridor Segment B	0.27
			South Corridor Segment D	1.95
			South Corridor Segment E	0.55
			Jordan West Corridor	2.20
	Jordan Route 4	9.67	North Corridor Segment A	0.85
			North Corridor Segment B	1.39
			North Corridor Segment C	0.45
			South Corridor Segment A	0.87
			East Corridor Segment A	1.15
			East Corridor Segment B	0.27
			South Corridor Segment D	1.95
			South Corridor Segment E	0.55
			Jordan West Corridor	2.19

Table 2-9. Potential CO_2 Pipeline Corridors and Alternative Routes *(Continued)*

Potential Injection Well Property	Route or Alternative Route	Route Length (miles)	Segments That Comprise Route	Segment Length (miles)
Western Sporn Tract	Western Sporn Route	5.69	North Corridor Segment A	0.85
			Western Sporn Corridor	3.68
			Foglesong Corridor	1.16

CO_2 = carbon dioxide; NA = not applicable

2.3.4.2 System Component Overview

Captured CO_2 would be transported via pipelines (located primarily underground) to the injection wells. The pipelines would be similar in design and operation to other pipelines (e.g., natural gas) common in West Virginia. The CO_2 pipelines would be designed, tested, and operated in accordance with all applicable federal regulations. These include the U.S. Department of Transportation (DOT) regulations and the U.S. Department of Labor OSHA requirements. These regulations are intended to ensure adequate protection of the public and to prevent pipeline accidents and failures. The proposed pipelines would be sited in accordance with applicable federal regulations, including 49 CFR 195, *Transportation of Hazardous Liquids by Pipeline*. Applicable pipeline siting requirements include Section 195.210, *Pipeline Location*:

- Pipeline ROWs must be selected to avoid, as far as practicable, areas containing private dwellings, industrial buildings, and places of public assembly.
- No pipeline may be located within 50 feet of any private dwelling, or any industrial building or place of public assembly in which persons work, congregate, or assemble, unless it is provided with at least 12 inches of soil cover in addition to that prescribed in 49 CFR 195.248 (Cover Over Buried Pipeline).

The main components of the proposed pipeline would include pipeline materials, controls, and monitoring systems. The pipeline would be constructed of carbon steel and range from approximately 8 to 12 inches in nominal diameter. The pipelines would operate at pressures up to 3,000 psi. AEP would prepare the final design of the pipeline during the design phase of the project.

All pipelines would be installed below ground, except for locations where the pipeline would cross a vertical rock outcropping. The only pipeline features that would potentially be visible along the route would be: (1) minimal locations where the pipeline crosses a vertical rock outcropping; (2) pipeline location markers (primarily positioned at road and stream crossings, fence lines, or in areas where pipeline is above the ground surface); and (3) cathodic protection test posts located on each side of all road crossings. The location posts would be 4.5-feet tall and display the mileage as well as a cautionary statement such as, “In case of emergency or before digging, call (owner’s name and telephone number).”

AEP would follow common industry practice for pipelines of this length and install shut-off valves at the beginning and end of each pipeline route. Refer to Table 2-10 for more specific characteristics of each potential CO_2 pipeline route, including number of stream crossings, wetland areas within the construction ROWs, and number of residences within 500 and 1,000 feet of the potential routes. There are no hospitals or schools located within 1,000 feet of any of the pipeline routes.

Table 2-10. Summary of Potential CO_2 Pipeline Routes

Pipeline Route Name	Route Length (miles)	Existing ROW (miles)	New ROW (miles)	Number of Stream Crossings	Wetland Areas within Construction ROW (acres)	Residences near Pipeline, within[a]:	
						1000 ft	500 ft
Plant Routing	0.13	0.13	0	0	0	0	0
Borrow Area Route	2.24	2.24	0	7	5.36	0	0
Eastern Sporn Route 1	5.00	4.34	0.66	24	5.54	2	1
Eastern Sporn Route 2	8.22	8.03	0.18	48	6.00	12	2
Eastern Sporn Route 3	5.11	3.57	1.54	25	5.55	5	1
Eastern Sporn Route 4	8.65	7.09	1.56	38	6.05	16	3
Jordan Route 1	9.25	8.23	1.02	53	6.21	11	4
Jordan Route 2	9.24	8.90	0.34	57	6.07	11	3
Jordan Route 3	9.68	7.27	2.41	55	6.26	15	5
Jordan Route 4	9.67	7.94	1.73	59	6.14	15	4
Western Sporn Route	5.69	4.5	1.19	34	5.68	42	19

[a] There are no hospitals or schools located within 1,000 feet of any of the pipeline routes.
CO_2 = carbon dioxide; ft = feet; ROW = right-of-way

2.3.4.3 Construction Phase

Typical pipeline construction corridors would require a construction ROW of approximately 80 feet to 120 feet in width. However, in stretches with steep side slopes, the ROW width may need to be up to 20 percent wider (i.e., up to approximately 144 feet) to achieve a workable and safe ROW grade. The permanent pipeline ROW would be approximately 50 feet wide. AEP would obtain the required ROWs for both the pipeline corridors and construction access roads. Figure 2-8 shows typical pipeline construction methods. Construction of the proposed pipelines would take place over approximately 18 months beginning in July 2013.

Construction techniques may include excavated trenching, boring, tunneling, and directional drilling. Typical pipeline construction equipment would include pipelayers, track hoe excavators, trenching machines, mobile cranes, bulldozers, motor graders, dump trucks, front-end loaders, portable welding rigs, radiographic inspection equipment, pipe bending machines, water pumps and filters, transport trucks, and crew trucks and buses. The size and quantity of equipment would vary based on the length and diameter of the pipe, as well as the terrain characteristics and obstacles that would be traversed by the pipeline. During pipeline construction, materials would be staged adjacent to the pipeline ROWs or trucked in as necessary.

Blasting would be required where consolidated rock cannot be trenched or ripped; however, locations where blasting would be needed are unknown at this time. To ensure that blasting impacts are minimal, AEP would develop a blasting plan for safety purposes and would notify occupants of nearby buildings, residences, agricultural areas, and other areas of public gathering sufficiently in advance. Blasting, if required, would occur on an intermittent basis over a relatively short period of time.

During site preparation, the full width of the ROW (i.e., including temporary and final ROW) would be cleared of trees and brush. After clearing, the ROW would be graded so that equipment could operate safely. Next, the trench for the pipeline would be excavated. The soil removed during trenching would be placed on one side of the trench, while the opposite side would be used for pipeline welding operations and operation of other equipment. Welds would be radio-graphically inspected before a protective coating is applied to welded areas, and the pipe lowered into the trench.

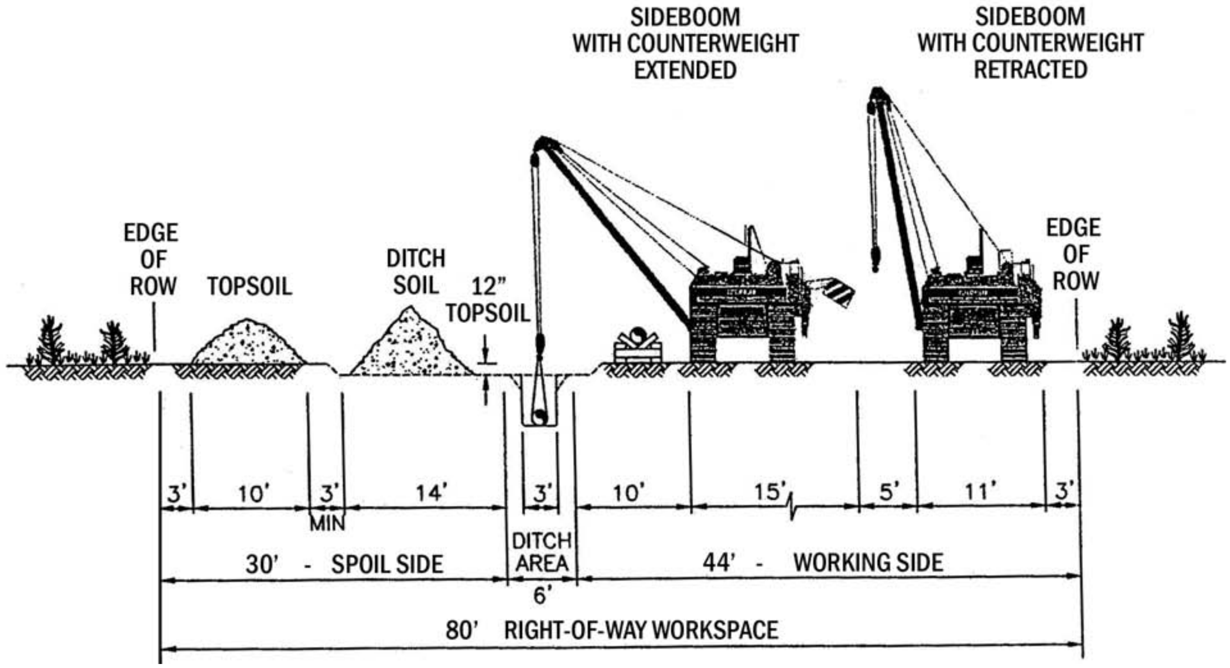


Figure 2-8. Typical Pipeline Construction Methods

Source: INGAA, 1999
min = minimum; ROW = right-of-way; ' = feet; " = inches

The topsoil would be temporarily stored separately from other excavated material and in a manner to minimize erosion in accordance with the stormwater permit. A majority of the excavated material would be returned to the trench and the site would be restored to its original grade. The topsoil would be replaced as the upper-most soil layer following pipeline construction. Excavated rock, like most other spoils from the trench, would likely be placed back in the trench after suitable backfill material has been placed around the pipe. In cultivated land, rock would not be returned to the trench so that farming practices would not be affected.

Typically, the pipeline would be covered by a minimum of 3 feet of compacted soil. The pipeline would be buried deeper (minimum of 4 feet in cultivated areas) or would be encased in reinforced concrete when needed to accommodate planned surface activities or when crossing under roadways. Techniques for crossing streams would depend on considerations of safety, environmental compliance, and efficiency factors specific to the particular location. After lowering and backfilling of the pipeline in the trench, the pipeline would be tested by filling the pipeline (or section of pipeline) with water and pressure-tested using pressures higher than the normal operating pressures (i.e., hydrostatic testing, or hydrotesting). After pipeline installation is complete, the ROW would be revegetated.

Wastes generated from the construction of the proposed CO_2 pipeline would primarily consist of land clearing waste and spent hydrotesting water generated during the hydrostatic testing of the pipelines. The pipeline contractor would be tasked with providing an acceptable plan for offsite disposal (i.e., landfills, other construction areas needing fill material, etc.) of any debris that is not suitable for placement on the ROWs.

Construction water use would be heaviest during the hydrostatic testing of the pipelines. Hydrotesting water would be reused for subsequent pressure tests if practicable. Spent hydrotesting water would be tested to properly characterize the waste prior to disposal. It could be routed to the Mountaineer Plant's outfall for discharge in accordance with the project's NPDES permit.

Laborers for the construction of the pipelines would largely be drawn from the pool of workers discussed under Section 2.3.3.3. AEP would provide the construction workers with potable water, portable toilets, and hand-wash stations.

2.3.4.4 Operation Phase

The DOT Pipeline and Hazardous Materials Safety Administration would have regulatory jurisdiction over the proposed CO_2 pipeline. The CO_2 pipeline would be designed, operated, and maintained in accordance with federal DOT Safety Standards in 49 CFR 195. The safety standards specified in 49 CFR 195 require the pipeline operator (AEP) to

- develop and implement an emergency plan (see below), working with local fire departments and other agencies, to identify personnel to be contacted, equipment to be mobilized, and procedures to be followed in responding to a hazardous condition caused by the pipeline or associated facilities;
- establish and maintain a liaison with the appropriate fire, police, and public officials to coordinate mutual assistance when responding to emergencies; and
- establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a CO_2 pipeline emergency and report it to appropriate public officials.

Key elements of any emergency plan would include procedures for

- receiving, identifying, and classifying emergency events such as gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials and coordinating emergency responses;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- proactive protection for people and insuring human safety from actual or potential hazards; and
- emergency shutdown of the system and safely restoring service.

Before placing a pipeline in service, AEP would prepare a procedure manual for operation and maintenance of the pipeline. During operations, AEP would monitor and maintain the pipelines in compliance with all regulatory requirements. Typical monitoring and maintenance procedures could include

- population density survey, once every 2 years;
- ROW inspection, 26 times each year (i.e., every 2 weeks);
- valve maintenance and inspection, twice each year;
- emergency systems check, once each year;
- rectifier maintenance, 6 times each year;
- cathodic-protection survey, once each year;
- internal inspection of the pipeline using an electronic tool, every 7 years or more frequently if necessary;
- check of overpressure safety devices, once each year; and
- public awareness and damage prevention program, once each year.

ROW inspections would be conducted to identify dry vegetation, soil erosion, unauthorized encroachment, or other conditions that could result in a safety hazard or require preventative repairs or maintenance. Inspections would also ensure that no third party activity would likely jeopardize the pipeline (e.g., via excavation). Cathodic protection surveys would be conducted annually to ensure that corrosion protection is adequate.

Inspection activities may require that pipeline "pigging" be performed occasionally to displace water during or after long periods of reduced flowrate or to displace contaminants after an upset condition. Ongoing design would determine the necessary procedures to protect the pipeline when it is not in service. Options under consideration include the application of protective pipeline linings and/or the use of nitrogen or other inert gas filling to minimize potential performance or integrity concerns. None of the maintenance activities for the proposed pipeline are expected to produce any appreciable quantities of waste.

> Pigging refers to the practice of using pipeline inspection gauges or 'pigs' to perform various operations on a pipeline without stopping the flow of the product in the pipeline. These operations include, but are not limited to, cleaning and inspection of the pipeline.

2.3.5 CO_2 Injection Wells

2.3.5.1 Location and Background

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 formations are too shallow and others have low permeability (i.e., the ability of rock to transmit fluids through pore spaces) or poor confining characteristics. Formations suitable for CO_2 storage have sufficient permeability and porosity to allow for injection and movement of CO_2, as well as adequate confinement layers to prevent upward migration. These characteristics are common with formations that have thick accumulations of sediments or rock layers, permeable layers saturated with saline water (i.e., saline formations), extensive covers of low permeability sediments or rocks acting as seals (i.e., caprock), and lack of transmissive faults (i.e., gaps that allow gas or fluid to escape).

The captured CO_2 would be transported by pipeline to injection wells for permanent geologic storage. AEP is considering five AEP-owned properties for the location of the CO_2 injection wells:

- **Mountaineer Plant -** Located near the proposed CO_2 capture facility (see Figure 2-9)
- **Borrow Area -** 2.24 miles south of the Mountaineer Plant (see Figure 2-10)
- **Eastern Sporn Tract -** 4.5 miles south of the Mountaineer Plant (see Figure 2-11)
- **Jordan Tract -** 10.5 miles south of the Mountaineer Plant (see Figure 2-12)
- **Western Sporn Tract -** 6 miles west of the Mountaineer Plant (see Figure 2-13)

AEP identified the Mountaineer Plant and the Borrow Area as preferred injection properties. AEP prefers the Jordan Track property over the Eastern Sporn Tract. The Western Sporn Tract is the least preferred property due to its small size, potential for increased environmental impacts, increased project construction and operation expenses associated with a required separate pipeline route, and the potential need to upgrade local access roads along the CO_2 pipeline corridor. The ultimate location of the injection

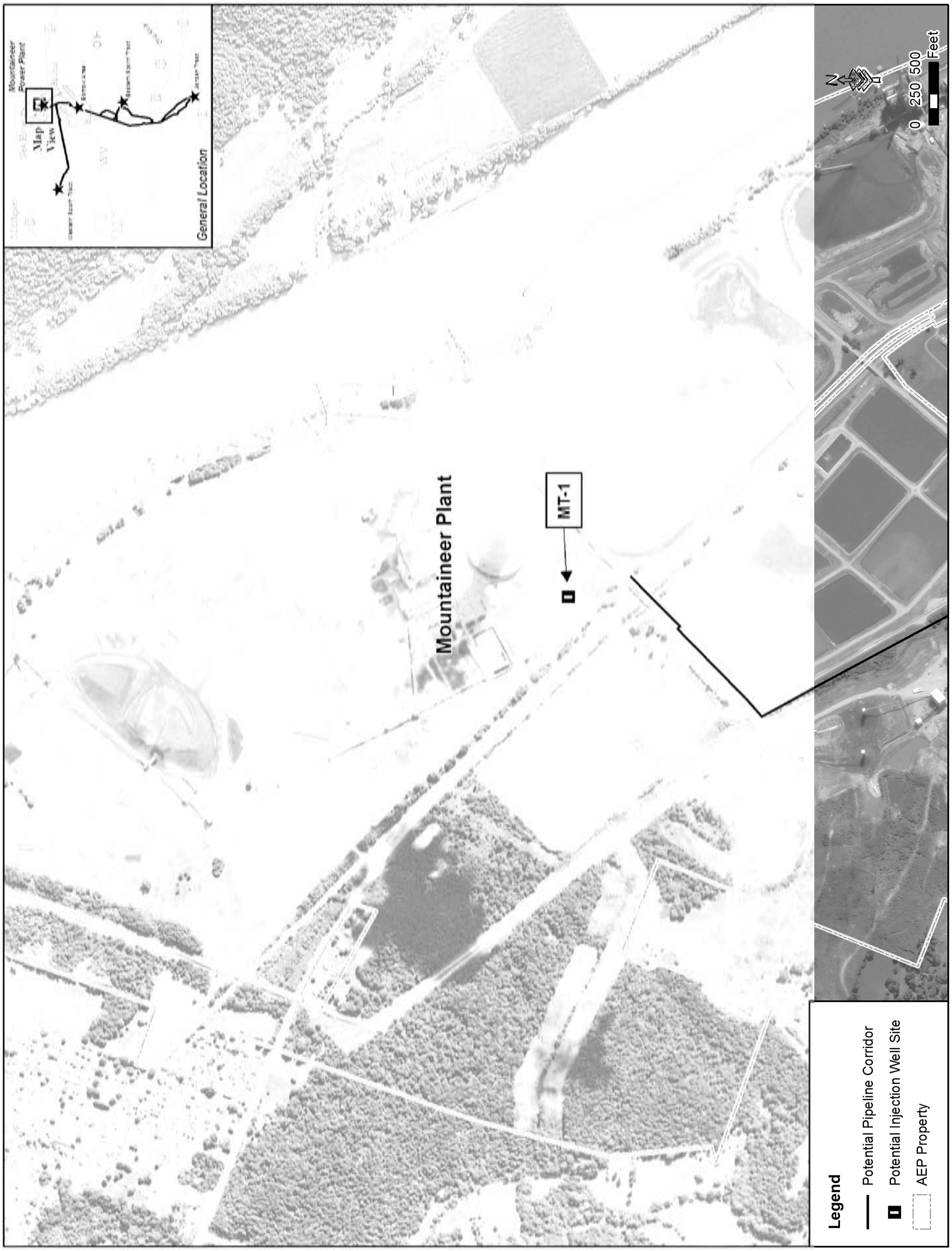


Figure 2-9. Mountaineer Plant

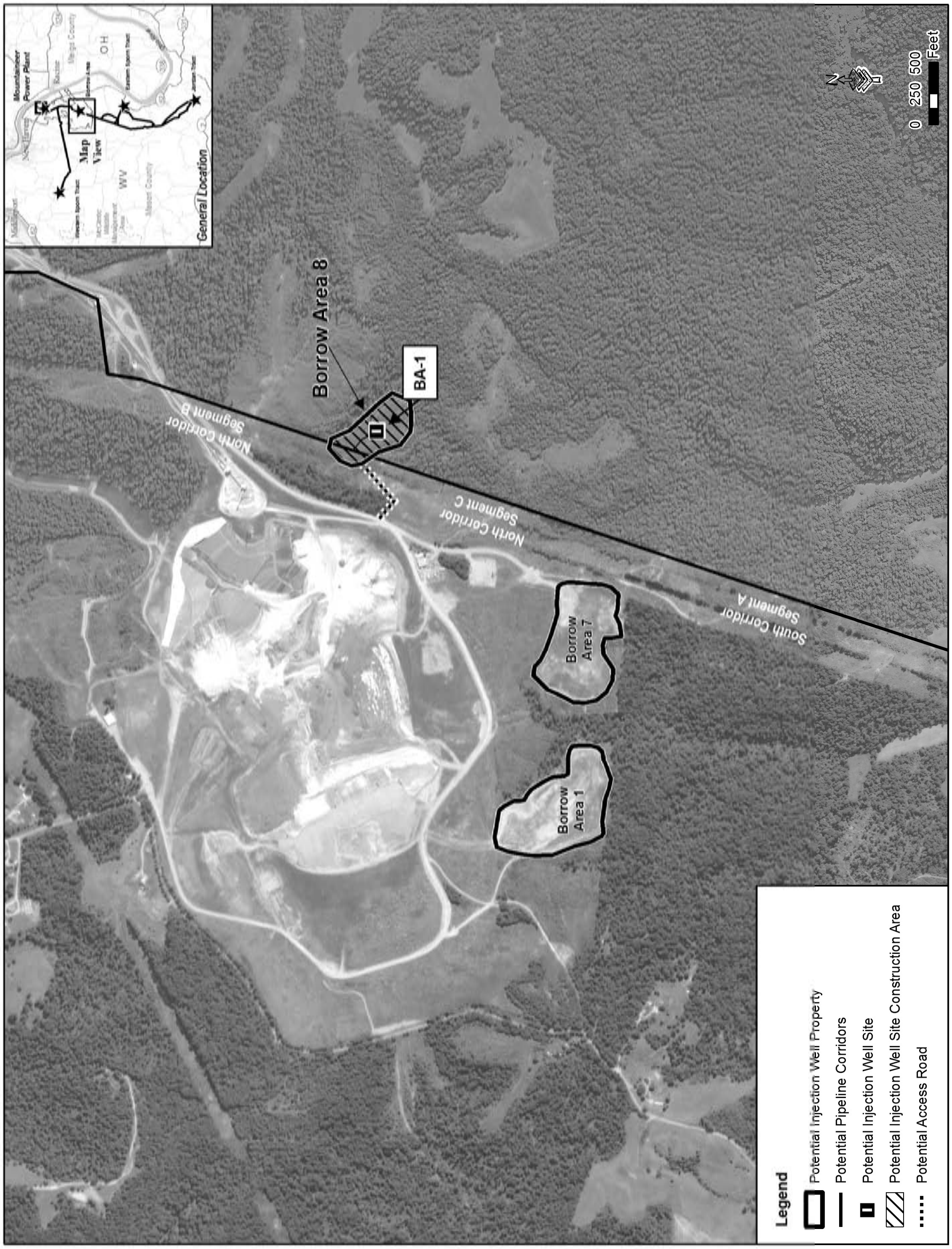


Figure 2-10. Borrow Area

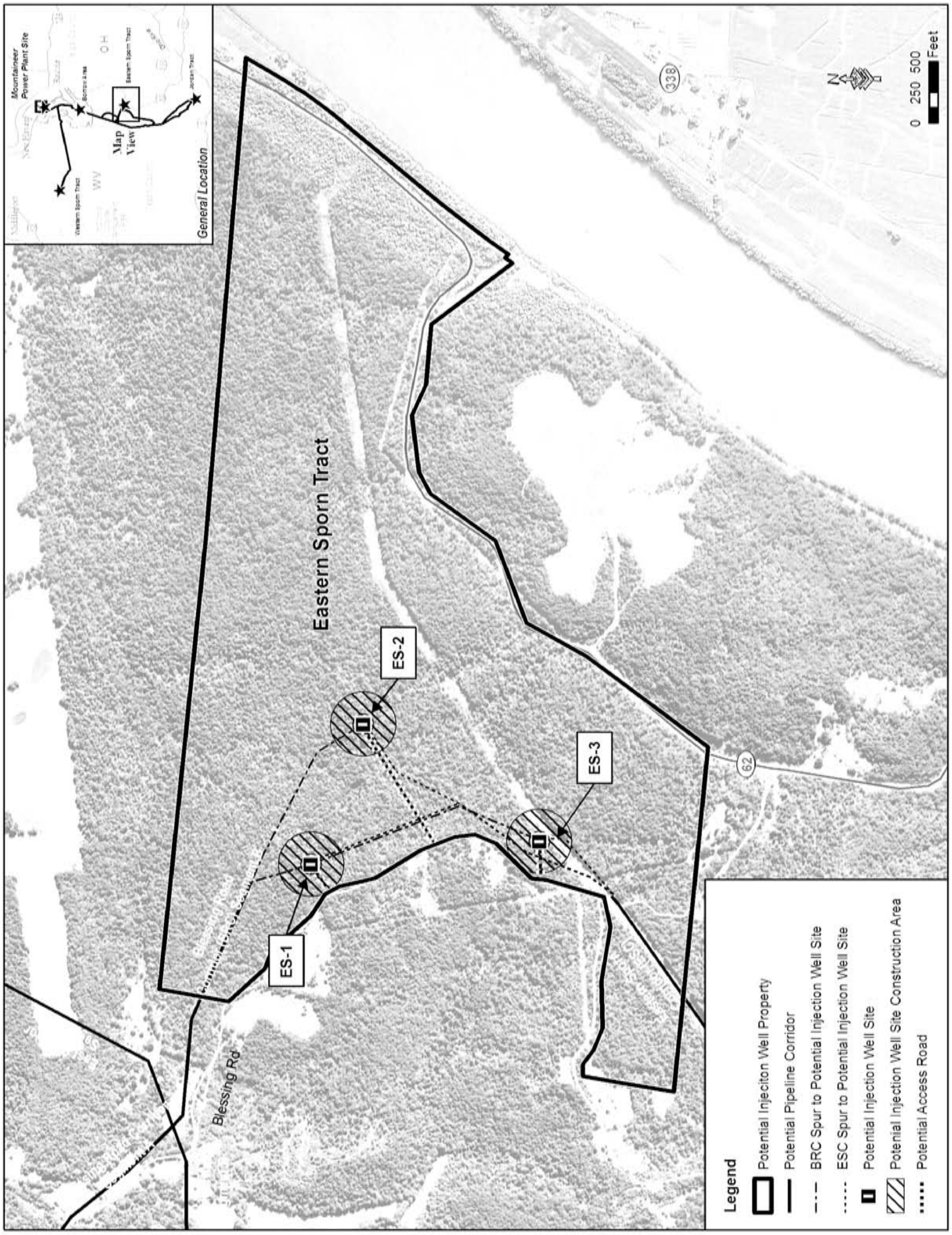


Figure 2-11. Eastern Sporn Tract

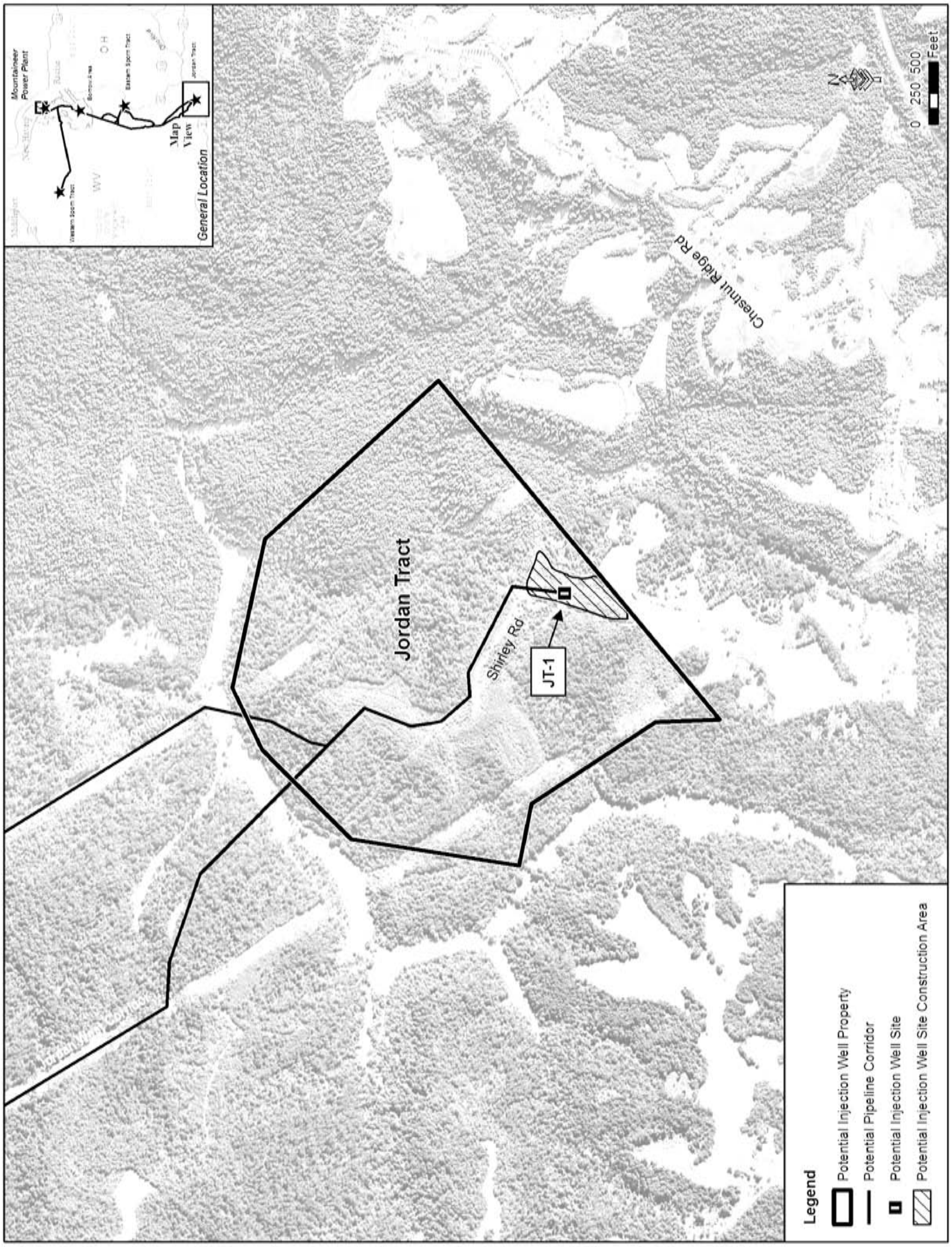


Figure 2-12. Jordan Tract

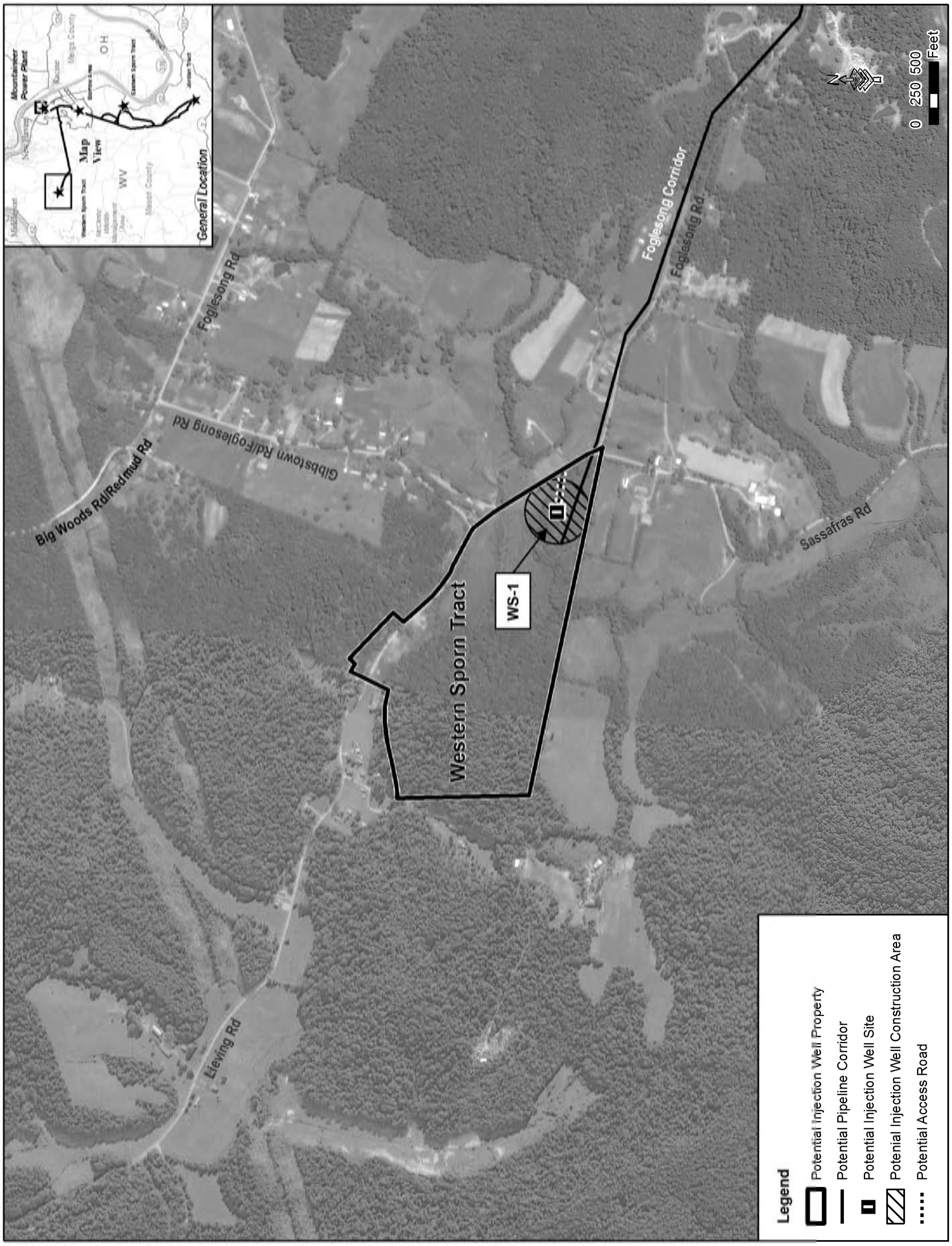


Figure 2-13. Western Sporn Tract

wells would be determined by AEP based on the outcome of geologic assessment activities, including seismic evaluations, characterization wells, and the environmental analysis contained within this EIS.

AEP anticipates that the project would require four to eight injection wells, located in pairs, at two to four different properties. For each pair of wells, AEP expects that one well would inject into the Rose Run Formation and the other well would inject into the underlying Copper Ridge Formation. Final design will be based on the results of the geologic characterization study and subsequent project design and permitting.

AEP identified preferred injection well sites on each of the five properties as shown in Figures 2-9 through 2-13. The preferred injection well sites are labeled as: Mountaineer Plant Injection Well Site MT-1, Borrow Area Injection Well Site BA-1, Jordan Tract Injection Well Site JT-1, Eastern Sporn Tract Injection Well Sites ES-1, ES-2, and ES-3, and Western Sporn Tract Injection Well Site WS-1. AEP selected the preferred sites based on each site's suitability for construction and operation, and based on AEP's siting criteria (see Section 2.3.1). The final location of the injection wells would depend on the results of geologic characterization studies being conducted by AEP to determine the optimal locations and design. If this information becomes available, it would be used to update the data and analyses presented in the Final EIS.

As part of the geologic characterization well studies, AEP plans to initially install geologic characterization wells at the Borrow Area and the Jordan Tract to collect data of both the target injection formations and the overlying caprock. If sufficient data is not obtained from these wells to determine injection well placement and design parameters, then additional characterization wells could be installed at one or all of the remaining three properties. AEP is using the injection data collected at the Mountaineer PVF, data from characterization studies, and a numerical simulation model for analyzing potential injection location suitability. Characterization data would be fed into the model to further refine its accuracy and projected injectivity rates and conditions. From these projections, AEP would determine the number and optimal placement of the injection wells required to handle the CO_2 from the CAP system. Potential impacts resulting from characterization activities are addressed in the cumulative impact analysis, Section 4.2, of this EIS.

2.3.5.2 System Component Overview

The project would store approximately 1.5 million metric tons of CO_2 per year in geologic formations located approximately 1.5 miles below the ground surface. Four to eight injection wells are expected to be needed, each with an estimated injection capacity of 500,000 metric tpy. AEP identified multiple sites on five AEP-owned properties that could be used for siting injection wells. AEP anticipates that each injection well site would have two injection wells to provide flexible injection options, as shown in Figure 2-14. Final design of the number and location of injections wells for the project would be determined based on results of an ongoing geologic characterization study.

It is expected that one well would access the Rose Run Formation (composed primarily of sandstone) and the other would access the Copper Ridge Formation (composed primarily of dolomite). Wells would be approximately 7,500 to 8,500 feet deep. The Rose Run and Copper Ridge Formations are at a much greater depth than groundwater aquifers that are potential sources of drinking water, which are present up to 250 feet below ground surface (bgs).

Once injected into these formations, the CO_2 would be trapped underground by a confining zone which includes impermeable layers of rock known as "caprock." Caprock consists of thick (hundreds or thousands of feet) layers of non-porous rock that act as caps or seals to trap the injected fluid. Caprock has very low permeability–the lack of connected pore spaces that would allow liquid or gas to pass through. The CO_2 injected into these formations might extend to an estimated radius of 3 miles from each injection well site. The geologic characterization study will be used to refine these estimates and support the UIC permitting process.

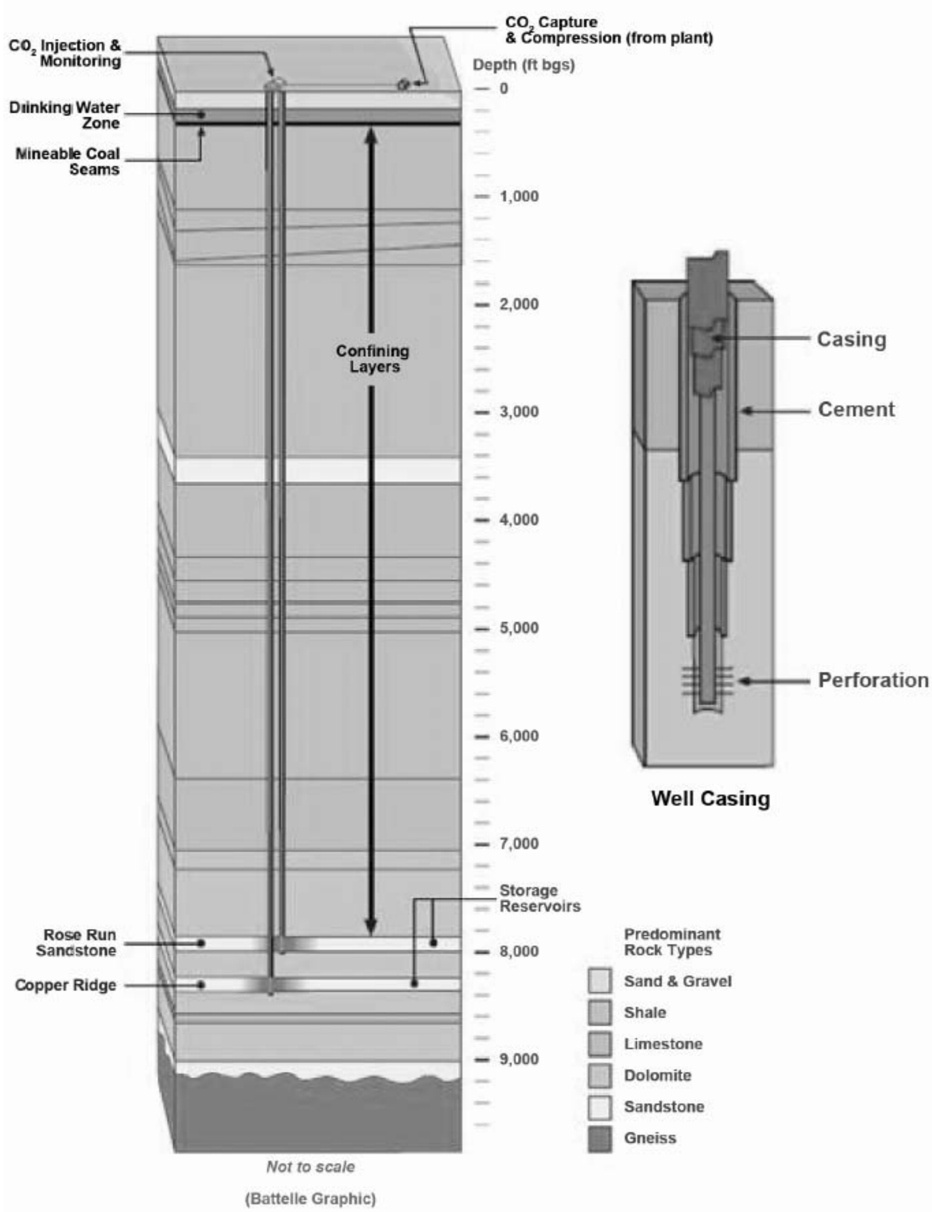


Figure 2-14. Existing Mountaineer Plant PVF Injection Well Cross-Section

On December 10, 2010, the EPA published a final rule, "Federal Requirements Under the UIC Program for CO_2 Geologic Sequestration Wells" (*Federal Register*, Vol. 75, No. 237; the "Class VI rule") (75 FR 43492). Under this rule, the EPA created a new category of injection wells (i.e., Class VI wells) with new federal requirements to regulate the injection of CO_2 for geologic sequestration and ensure the protection of underground sources of drinking water (USDW). The new rule for Class VI wells builds on the program elements currently in place as part of the UIC Program, including siting, area of review, well construction, operation, mechanical integrity testing, monitoring, and well plugging and post-injection site care. West Virginia will have 270 days after the final rule publication to apply for state primacy of the Class VI wells. If West Virginia does not submit an application for primacy within the 270-day deadline, then permits would be issued from the federal UIC Class VI program. Until the West Virginia

Class VI UIC program is approved, West Virginia would issue a permit under the one of the existing classes, with the understanding that the permit would be re-issued as Class VI once primacy is achieved.

Currently, injection of CO_2 is being performed at the Mountaineer Plant PVF in accordance with a Class V experimental wells permit issued by the West Virginia Department of Environmental Protection (WVDEP). The injection wells for the project would be required to obtain a separate UIC permit. New CO_2 injection wells would be permitted as Class V wells until the Class VI proposed regulations are implemented. It is expected that the UIC Permit would also require monitoring wells to be installed (see Section 2.3.6).

2.3.5.3 Construction Phase

The construction of each injection well would be completed in three phases over a period of approximately 4 months:

- Phase 1: Site Preparation (1 month)
- Phase 2: Drilling (2 months)
- Phase 3: Stabilization and Site Restoration (1 month)

The site preparation phase would take approximately 1 month to complete, during which time the site would be cleared of trees and graded; mud pits would be excavated and lined; and access roads would be constructed, as necessary. Trucks would be required to bring fill material for access roadways as necessary, remove debris from the construction sites, and stockpile fill material.

AEP would construct access roads to each injection well from existing, adjacent public roads. Gravel and road base would be used for the access roads, material storage areas, and parking areas. Access roads would have road widths from 12 to 15 feet, with approximate 5-foot drainage ditches on each side. Thus, the total disturbance corridor for each access road would be approximately 25 to 30 feet in width. Figures 2-9 through 2-13 show the potential access roads to each injection well site.

The access roads would be constructed to accommodate trucks up to 40 tons. AEP reviewed existing public roads for the Jordan Tract and Borrow Area sites and concluded that the existing public roads would not require improvement to accommodate drilling rigs and support equipment. Although a formal evaluation has not been completed, it is likely that improvements would be needed to existing roadways leading up to the Eastern Sporn and Western Sporn Tracts to accommodate drilling rigs and support equipment. AEP would coordinate with applicable regulatory agencies (e.g., West Virginia Department of Transportation (WVDOT), local authorities, etc.) to obtain all necessary approvals required to implement the appropriate roadway improvements. Roadway improvements would occur prior to any construction activities at the injection well sites to ensure that the necessary transportation infrastructure is in place to support the number and types of vehicles expected to access the sites during the construction and operation phases.

During construction, each injection well site would require approximately 5 acres to support the construction process. AEP may install semi-permanent fencing around the construction site to control access during drilling operations. As the last step in this phase, the equipment, materials, and temporary infrastructure required to support the drilling operations would be brought onsite. Potable (drinking) water, portable toilets, and hand-wash stations would be provided for use by construction workers at each property.

Figure 2-15 shows a conceptual well construction layout, including typical facilities and equipment that would be required to support drilling operations. This equipment would include the following:

- **Drilling Rig** – a mobile drilling rig with a portable tower derrick (120 to 180 feet in height)
- **Pipe Racks** – temporary structures used to hold (1) drilling pipe before and after use and (2) well casing and tubing before it is installed into the well
- **Storage Sheds** – for equipment and materials storage
- **Office Trailers** – trailers or conex boxes for temporary office space, break areas, or equipment storage areas.
- **Air Compressors** – very large portable air compressors with self-contained diesel-powered generators to supply air to drilling rig
- **Generators** – self-contained portable diesel-powered generators to supply power to construction equipment and facilities as needed

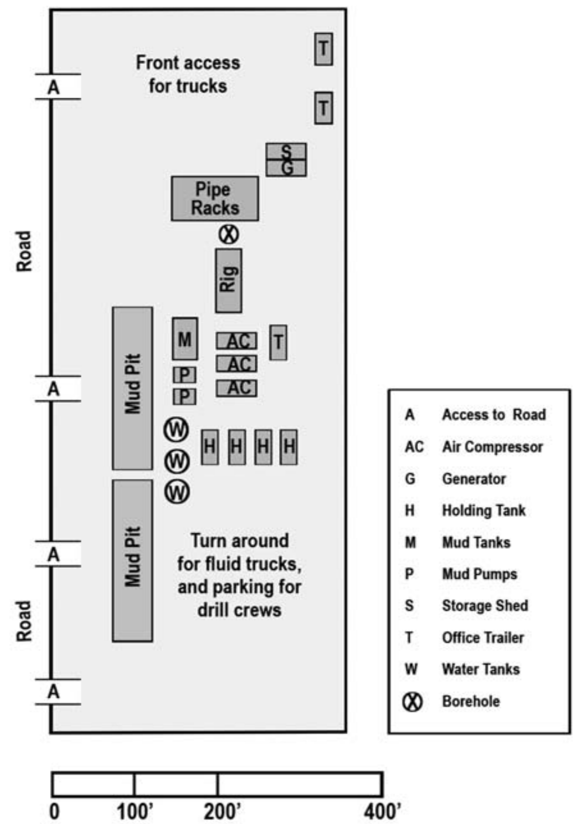


Figure 2-15.

Typical Layout of Well Site during Construction

- **Holding Tanks** – large, tractor-trailer sized storage tanks for temporary storage of drilling fluids or other fluids (i.e., brine, formation fluids, and acid) that are pumped from the well (may also be used for storage of non-potable water or brine to support drilling operations)
- **Water Tank** –for the storage of non-potable water
- **Mud Tanks** –for mixing drilling fluids (drilling mud)
- **Mud Pits** – pits excavated in the ground lined and used for the temporary storage of drilling fluids during drilling operations
- **Mud Pumps** – used to convey drilling fluids from mud tanks to the borehole

Drilling of each injection well would take approximately 2 months and would be conducted on a 24-hour basis. A smaller drilling rig would first be brought onsite to drill the first section of the borehole and set the surface casing to approximately 300 feet below ground. After this is completed, additional site preparation may be required to make way for a larger rig (as shown in Figures 2-16 and 2-17) that would be used to finish the well.

Drilling of the well results in crushed or cut rock (cuttings) that are collected at surface in lined mud pits. The mud pits, as shown in Figure 2-18, are designed so that small rock particles that were not filtered out of the fluid can settle out in the pits. The drilling fluid is then pumped back down the hole and further re-circulated.

Drilling would be completed in intervals as shown in Table 2-11. At each interval, casing of smaller diameter is successively placed within the previous well casing. The casing is installed into the well and cemented in place by pumping cement slurry between the casing and the sides of the borehole. Each well would be designed and constructed to prevent any escapement of stored CO_2. The base of each injection well would use CO_2-resistant cement.

Figure 2-16. Typical Drill Rig with Derrick

Hydraulic fracturing, or stimulation, may be required during injection well construction or during future maintenance of the wells to increase or restore the injectivity of the storage formation. During hydraulic fracturing, a fracturing fluid is pumped into the target formation at a very high pressure, such that the formation begins to crack (i.e., fracture), which allows injected CO_2 to more readily flow through the storage formation. The maximum stimulation pressure would be limited to a value sufficiently below the parting pressure of the adjacent caprock formation, so as to maintain the integrity of the containment system. The evaluation to determine whether hydraulic fracturing would be required would be performed during: (1) the geologic characterization study; (2) later injectivity testing; and/or (3) operational phases. In the event that hydraulic fracturing would be needed, AEP would prepare and submit a detailed plan to the WVDEP for review and approval.

After the well casing has been installed and cemented in place, the final phase of the well construction process (i.e., stabilization and site restoration) would be initiated. The drilling rig and derrick would be dismantled and taken offsite and the well site would be restored. All drilling equipment and infrastructure would be removed from the site, the mud pits would be filled in, and the site would be regraded as necessary. The disturbed soils would be reseeded and restored to pre-construction conditions. In the event that roads are damaged through site construction activities, AEP would perform, if necessary, repairs to return the roadway to its as-found condition.

Figure 2-17. Typical Drill Rig in Transport

Figure 2-18. Lined Mud Pit

Wastes that would be generated from the construction of the injection wells would include drill cuttings and fluids, as well as land clearing waste. AEP anticipates that approximately 120 cubic yards of general solid waste would be generated during the construction of each injection well, which would be properly disposed of in a licensed solid waste landfill.

Drill cuttings and fluids would be placed in the proposed onsite mud pits. Light fluid would be removed (pumped off) from the mud pits into brine trucks and hauled offsite for proper disposal by a licensed service vendor. The drill cuttings would be stabilized prior to disposal offsite. Approximately 350 cubic yards of drill cuttings would be generated during the construction of each injection well.

Soil removed for the construction of the mud pits would be used to regrade the overlying area and to backfill the mud pit excavations. In the event that shallow groundwater is encountered during drilling activities, the groundwater would be directed to mud pits for temporary storage. Any excess water would be hauled offsite for proper disposal by a licensed fluid hauling and disposal vendor. There would be no disposal of groundwater to the surface.

Laborers for the construction of the injection wells would largely be drawn from the pool of workers discussed under Section 2.3.3.3. AEP would provide the construction workers with potable water, portable toilets, and hand-wash stations.

Table 2-11. Typical Injection Well Characteristics

Casing String	Casing Diameter (inches)	Borehole Diameter (inches)	Cemented Interval (feet)	Approximate Set Depth (feet)
Shallow (Coal)	20	24	0 to 300	300
Shallow Intermediate	13 3/8	17 1/2	0 to 2,000	1,800
Intermediate	9 5/8	12 1/4	1,600 to 3,800	3,800
Deep	7	8 3/4	3,300 to 9,100	9,100

2.3.5.4 Operation Phase

Each injection well would require approximately 0.5 acre during operations. This 0.5-acre area would be maintained and kept clear of new tree or shrub growth. In addition, well maintenance activities would occur on an as-needed basis. The following maintenance activities could occur during operation of the proposed injection wells:

- **Well Workover –** Well workovers consist of pulling the tubing out of the well; inspecting the tubing, packer, and downhole assembly on the way out of the well; performing any necessary repairs or downhole modifications; and reassembling the well.
- **Wellhead Maintenance –** Wellhead maintenance includes greasing wellhead valves, replacing seals, and replacing any defective parts.
- **Acidizing –** Certain geologic formations require acidizing. This involves: hauling acid to the site in tanker trucks; pumping acid down the well; pressurizing the well to pump acid into target formations; swabbing the well to draw the spent acid out of the formation; collecting the acid-brine mixture in brine tanker trucks; and hauling the mixture to an appropriate disposal facility.
- **Swabbing –** During swabbing operations, pipe, wireline tools, or rubber-cupped seals are moved within the well to reduce pressure and draw fluids into the well and towards the surface. Fluids pumped from the well (i.e., brine, formation fluids, and potentially acid) are collected in brine tanker trucks by a service vendor and hauled to an appropriate disposal facility.

- **Stimulation –** Stimulation is a method of increasing access to the target formation so that injectivity of CO_2 is increased. Stimulation is typically performed by injecting a fluid under high pressure into the well to create fractures. Other additives may be used to keep the fracture open or to improve surface tension properties.

Wastes generated during the maintenance of injection wells would consist of old parts or seals that have been replaced on various well components. These would be properly disposed of as solid waste. During swabbing and fracturing operations, an acid-brine wastewater mixture would be generated that would be hauled offsite by a service vendor in brine trucks to an appropriate disposal facility. Brine wastewater would not be generated during normal CO_2 sequestration operations (aside from maintenance activities).

2.3.6 CO_2 Storage Monitoring

During the operational life of the Mountaineer CCS II Project, AEP would monitor the CO_2 injection process and storage integrity through the use of monitoring wells and any other methods required by the UIC permit. Monitoring wells of varying depths would be an integral part of the geologic storage monitoring program.

2.3.6.1 Location and Background

Similar to the process used for the design and location of the proposed injection wells, AEP would use data from the geologic characterization study to propose the location and quantity of monitoring wells in their UIC permit application to the WVDEP or EPA as applicable. The siting of these monitoring wells would be largely based on the monitoring objectives of the UIC permit. However, AEP would, to the greatest extent practicable, use the siting criteria identified in Section 2.3.1. Based on the siting criteria, AEP would avoid wetlands, streams, floodplains, sensitive habitats, and cultural resources when installing required monitoring wells. AEP would conduct all required additional field investigations and obtain all required additional permits and agency approvals in the event that monitoring wells would be sited in areas not already considered. Based on preliminary data, AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells if each monitoring well would sample both geologic target formations. AEP anticipates that monitoring wells would be located within 1,500 to 3,000 feet of the injection well; however, the UIC permit would dictate the final number and siting requirements for monitoring wells.

2.3.6.2 System Component Overview

An important part of the geologic storage program is the MVA that would be used to address regulatory and CCPI Program requirements. The UIC permit, however, would determine the minimum overall monitoring parameters for the proposed CO_2 storage system. Table 2-12 presents the monitoring objectives for the Mountaineer CCS II Project, along with the proposed methods for testing.

> MVA is the monitoring, validation, and accounting protocol used to: (1) measure the amount of CO_2 stored at a specific geologic storage site; (2) monitor the site and mitigate the potential for leaks or other deterioration of storage integrity over time; and (3) verify that the CO_2 is being stored successfully and is not harmful to the host ecosystem.

Table 2-12. Monitoring, Verification, and Accounting Options for Injection Wells

Monitoring Objective	Method Summary
Monitor the injection stream for chemical and physical characteristics	Collect periodic samples of CO_2 stream and analyze for composition.
Monitor corrosion of well materials	Monitor corrosion of well materials using coupons in contact with the CO_2 stream.
Monitor the quality of the shallow drinking water aquifer	Monitor groundwater wells completed in the shallow aquifers overlying the injection well site for chemical parameters that are indicators of CO_2 and/or brine presence.
Demonstrate that injection wells have adequate internal mechanical integrity	Conduct annular pressure tests to evaluate internal mechanical integrity of the injection wells.
Demonstrate that injection wells have adequate external mechanical integrity	Conduct temperature surveys or other tests (e.g., tracer survey) to evaluate external mechanical integrity of the injection wells.
Track the extent of CO_2 in the injection zone and monitor the caprock and confining zone	Conduct geophysical monitoring or other monitoring to determine vertical and horizontal position and size of CO_2 plume between injection and monitoring wells.
	Conduct periodic wireline logging to determine the vertical distribution of injected CO_2 adjacent to wells that penetrate the target formation.
	Collect fluid samples from the deep monitoring wells and analyze for parameters that are indicators of CO_2.
	Model CO_2 plume using computational modeling techniques.

CO_2 = carbon dioxide

The final design of the monitoring wells would be subject to the UIC permitting process as addressed in Section 2.3.5.2.

2.3.6.3 Construction Phase

Each monitoring well would be constructed in a similar manner as an injection well. Each monitoring well would likely require up to 5 acres during construction. Refer to Section 2.3.5.3 for details on the construction process.

2.3.6.4 Operation Phase

Monitoring can be divided into three primary types, including: (1) injection system monitoring; (2) confinement monitoring; and (3) CO_2 tracking in the injection zone. The final design of the monitoring program (i.e., to be defined in the project definition phase and the front-end engineering and design) would consider lessons learned from the current ongoing PVF, the monitoring technology assessments conducted under the Midwest Regional Carbon Sequestration Partnership (MRCSP) field projects, guidance from the project's Geologic Experts Advisory Team, and information from other field test programs in the U.S. and abroad.

Injection monitoring includes measurement of the rate, pressure, and temperature of the CO_2 being injected. It would also include monitoring of annulus pressure (i.e., the area between the CO_2 injection tube within the well and the long-string well casing), bottom-hole pressure, and temperature in vicinity of the well to correlate to surface injection pressures and temperatures.

AEP would use a well maintenance and monitoring system, similar to the one developed for the current PVF, to maintain pressure on the annulus fluid in the injection wells so that any potential leaks in the tubing or packer can easily be detected by changes in the annulus pressure. This system would also trigger automatic shutdown of the injection system if certain critical parameters are out of permissible limits (e.g., injection pressure). In addition to continuous monitoring of injection parameters, periodic (e.g., quarterly) sampling and analysis of the CO_2 injection stream would likely be conducted to monitor changes in the physical and chemical characteristics of the injectate. Samples would be obtained at a location in the capture system prior to the final compression stage (i.e., where pressures are low enough that the CO_2 would be in a gas phase, yet where the CO_2 composition is representative of the material that reaches the injection wells).

Confinement monitoring involves verifying the containment of the CO_2 within the injection zone. This would verify the CO_2 is not leaking outside of the confinement system. This would be accomplished using multiple techniques, including possible installation of monitoring wells in the USDW to verify whether the aquifer has actually been impacted by CO_2 or displaced brine.

Mechanical integrity testing, in particular external mechanical integrity tests, provides additional periodic verification of non-leakage along the outside of the wellbore. Carbon dioxide tracking techniques that could be employed (i.e., primarily for CO_2 plume identification and verifying containment within the injection zone) include specialized wireline logging techniques (e.g., pulsed neutron capture) and geophysical monitoring. These techniques are identified in Table 2-12.

Pressure monitoring and fluid sampling are two additional methods that could be employed to help track the distribution and movement of CO_2 in the injection zone. Both of these techniques are being used at the PVF. Analysis of pressure data collected from the PVF injection and monitoring wells would be used to characterize the response to injection. This would enable pressure data collected for the Mountaineer CCS II Project to be more readily and accurately interpreted. In the PVF program, fluid samples from the injection zone monitoring wells are annually collected and analyzed to: (1) evaluate the horizontal spreading of CO_2 at the location of the wells; (2) evaluate variations in CO_2 saturation; and (3) characterize geochemical interactions. In designing the monitoring program for the Mountaineer CCS II Project, AEP would consider fluid sampling techniques that may potentially allow more frequent sampling to be conducted in a cost-effective manner.

AEP does not anticipate atmospheric monitoring or soil gas monitoring as components of the monitoring program because such monitoring would be aimed at detecting CO_2 leakage at the ground surface; therefore, these techniques would not be protective of the USDW. Similarly, monitoring wells placed in the first formation overlying the confining zone would probably not be necessary since the other monitoring techniques that would be deployed are capable of detecting upward migration out of the injection zone.

Computational modeling is yet another CO_2 monitoring, predictive tracking, technique that could be used to support the MVA program. This technique predicts the vertical and horizontal distribution of the injected CO_2 and the extent of the pressure-affected area. Additionally, this is the only technology with the potential to give an indication of the plume growth in three dimensions and all directions. An extensive amount of modeling work has already been conducted for the PVF using the STOMP-CO_2 (PNNL, 2010) simulator to define the area of review, evaluate target formation injectivity, design injection scenarios, and predict CO_2 plume size. Additional modeling simulations could be performed once injection begins to allow the model to be calibrated with actual monitoring data collected during the active injection phase.

Each monitoring well would require 0.5 acre during operations. The final design of the MVA program would be defined by the UIC permitting process as addressed in Section 2.3.5.2.

2.3.7 Decommissioning

The project would be designed for 20 years of operation. AEP would develop a closure plan prior to decommissioning. The removal of the project facilities from service, or decommissioning, may range from "mothballing" to the removal of all equipment and facilities, depending on the conditions at the time. AEP would provide the closure plan to applicable regulators (as required) for review and approval.

The process would involve decommissioning all surface facilities, including connections between the Mountaineer Plant and the injection wells. All exposed pipes, along with other surface facilities, would be decommissioned and may be removed during site closure. AEP would plug and abandon all wells drilled for injection or monitoring in accordance with federal and state regulations; however, some monitoring wells may be required to remain in place to support post-injection monitoring activities.

AEP would conduct post-injection monitoring activities in accordance with applicable UIC regulations and permit conditions. The UIC program is evolving to specifically address geologic storage and its long-term safety (see Section 2.3.5.2). At this time, it is difficult to predict the types and frequency of post-operational monitoring and testing that may be required in the future. Both AEP and DOE also acknowledge the need for continued monitoring of the sequestered CO_2 during a period after injection ceases. AEP would apply a variety of monitoring techniques as described in Section 2.3.6. Implementation of appropriate monitoring techniques is a key factor for validating the successful geologic storage of CO_2.

2.3.8 Measures to Reduce Potential Impacts

This section presents some of the general measures that would be implemented to reduce potential impacts. Section 4.3, Mitigation of Impacts, includes a detailed resource-specific list of all BMPs and mitigation measures that have been proposed for the construction and operation of the project.

2.3.8.1 Stormwater Pollution Prevention

AEP would develop and implement erosion control methods and stormwater management plans to ensure compliance with the state's enforcement of the federal Clean Water Act (CWA) and applicable state standards. In addition, a stormwater construction permit would be obtained from the WVDEP to minimize potential impacts from stormwater. Preventative methods employed would be based on the terrain and soil characteristics of the work area. Typical methods include use of silt fences, hay bales, stabilization mats, crushed rock and stone, ditch plugs, diversion terraces, and retention ponds.

In accordance with 40 CFR 122.26, a project-specific construction Stormwater Pollution Prevention Plan (SWPPP) would be developed. The SWPPP would identify BMPs for erosion prevention and sedimentation control that would be implemented during construction. The SWPPP would include a description of construction activities and address, identify, and provide the following:

- Potential for discharging sediment and other potential pollutants from the site
- Locations and types of all temporary and permanent erosion prevention and sediment control BMPs, along with procedures to be used to establish additional temporary BMPs as necessary for the site conditions during construction
- Site map with existing and final grades, including dividing lines and direction of flow for all pre- and post-construction stormwater runoff drainage areas located within the project limits. The site map must also identify impervious surfaces and soil types
- Locations of areas not to be disturbed
- Locations of areas where construction would be phased to minimize duration of exposed soil areas
- Identification of surface waters and wetlands that could be affected by stormwater runoff from the construction site
- Methods to be used for final stabilization of all exposed soil areas

2.3.8.2 Noise and Light Control

Noise control measures that may be incorporated (as necessary) into the CAP facility design include: locating and orienting plant equipment to minimize sound emissions; providing buffer zones; enclosing noise sources within buildings; and including silencers on plant vents and relief valves. Potential noise associated with construction of the capture, transport, and well sites would be controlled in accordance with all regulatory requirements.

Lighting installed at the CAP facility and injection wells would be designed to reduce potential light and glare beyond the site boundary. All high-intensity lighting would be shielded. Exterior lighting for some areas would be designed to switch off when not in use, where such lighting is not necessary for security and safety.

2.4 CONSIDERATION OF ACTIONS IN THE EIS

2.4.1 Project Implementation Scenarios

The specific manner in which AEP would ultimately implement the project depends on a combination of factors. These factors include, but are not limited to, the results of geologic characterization study, pipeline routing constraints, UIC permitting conditions, and various cost factors. To assess the potential range of impacts that could occur from implementation of the project, several scenarios for proposed project implementation have been considered in this EIS (see Table 2-13). These scenarios present combinations of pipeline corridors and injection well properties that are representative of a reasonable range of options that could be implemented. These are not intended to provide an exhaustive list of options, but rather to bracket the range of available options and illustrate reasonable and plausible combinations.

DOE evaluated each of the scenarios listed in Table 2-13 in this EIS to assess the range of potential impacts that could occur and to properly bound the impact analysis. Assuming geologic characteristics are favorable at all locations, Scenario A would be AEP's preferred scenario and Scenario C would be AEP's least preferred scenario. This preference is based largely on cost, effort to implement, and environmental considerations. Scenario A would minimize these elements; Scenario C would maximize them. As such, Scenario C is the least preferable and considered to be the upper bound or "worst case" from an impact perspective because it would involve the greatest length of pipelines, the greatest number of required injection wells, and the greatest number of properties involved with the project. The number of injection wells on any one site would be based on the final design. It is possible that more than two wells would be required on one site; however, AEP does not anticipate that the total number of wells required for the project would exceed eight (upper bound).

Section 4.1 of this EIS summarizes and compares the potential impacts of the No Action Alternative and the three project implementation scenarios. The baseline conditions that are relevant to the No Action Alternative are described in Chapter 3 for each resource area. The potential impacts to each environmental resource area under the No Action Alternative and the Proposed Action are analyzed in depth in Chapter 3.

2.4.2 The Mountaineer CCS II Project and Connected Actions

This EIS analyzes the impacts of all components of the project, including those described in Section 2.3, as connected actions in accordance with NEPA (40 CFR 1508.25(a)(1)), regardless of the entity responsible for construction and operation of the specific component. A connected action is one that is closely related to the project, including an action that automatically triggers another action that may require an EIS; an action that cannot or would not proceed unless another action is taken previously or simultaneously; or an action that is an interdependent part of a larger action and depends on the larger action for its justification. Besides the connected actions associated with utilities (e.g., a new WWTP), monitoring wells, and access roads described in Section 2.3, no other connected actions regarding the project have been identified.

Table 2-13. Proposed Project Implementation Scenarios

Injection Well Property	Alternative Route	Scenario A "Lower Bound"	Scenario B	Scenario C "Upper Bound"
		Number of Injection Wells per Property		
Mountaineer Plant (MT-1 Location)	Plant Routing	2	0	0
Borrow Area	Borrow Area Route	2	2	2
Eastern Sporn Tract	Eastern Sporn Route 1	0	2	2
	Eastern Sporn Route 2			
	Eastern Sporn Route 3			
	Eastern Sporn Route 4			
Jordan Tract	Jordan Route 1	0	2	2
	Jordan Route 2			
	Jordan Route 3			
	Jordan Route 4			
Western Sporn Tract	Western Sporn Route	0	0	2

Note: These scenarios present combinations of pipeline routes and injection well properties that are representative of a reasonable range of options that could be implemented. Scenario A represents the lower bound (least wells and shortest pipeline) for impacts related to the number of wells and length of pipeline, while Scenario C represents an upper bound (most wells and longest pipeline). These are not intended to provide an exhaustive list of options, but rather to bracket the range of available options and illustrate reasonable and plausible combinations.

2.4.3 Amine-Based Capture System Feasibility Study

In order to evaluate potential impacts associated with the consideration of an amine-based CO_2 capture technology as a preliminary project option, DOE identified impacts in the DEIS typically associated with amine-based capture technologies. For the purpose of supporting this impact analysis of the preliminary project option, DOE assumed that the area required to construct an amine-based system would be less than or equal to that identified for the proposed technology. Adverse impacts associated with amine-based capture technologies are presented in Chapter 3 only for the resource areas in which it is expected that the impacts would be different from those identified for the proposed technology.

2.4.4 Cumulative Impacts

This EIS addresses the impacts of the project incrementally when added to the impacts of other past, present, and planned or reasonably foreseeable future projects within the geographic area. The evaluation of cumulative impacts was developed in accordance with the cumulative impact analysis requirements of CEQ Regulations (40 CFR 1508.7). See Section 4.2, Potential Cumulative Impacts, for further information.

3 AFFECTED ENVIRONMENT AND IMPACTS

3.0 CHAPTER INTRODUCTION

3.0.1 Chapter Organization

This chapter describes the existing physical, biological, cultural, social, and economic conditions within the region of influence (ROI) for the Mountaineer CCS II Project, as well as the potential impacts of the Proposed Action and the No Action Alternative in relation to these baseline conditions. The ROI defines the geographic extent of potential impacts on the important elements of a respective resource. The ROI includes, at a minimum, the proposed CO_2 capture facility, CO_2 pipeline corridors, and the injection well properties. However, the size of the ROI varies by resource depending upon the extent of potential impacts on respective resources. The ROI for each resource area is defined in the following subsections.

This chapter is organized into sections for 18 resource areas, as listed below:

- Air Quality and Climate (Section 3.1)
- Greenhouse Gases (Section 3.2)
- Geology (Section 3.3)
- Physiography and Soils (Section 3.4)
- Groundwater (Section 3.5)
- Surface Water (Section 3.6)
- Wetlands and Floodplains (Section 3.7)
- Biological Resources (Section 3.8)
- Cultural Resources (Section 3.9)
- Land Use and Aesthetics (Section 3.10)
- Traffic and Transportation (Section 3.11)
- Noise (Section 3.12)
- Materials and Waste Management (Section 3.13)
- Human Health and Safety (Section 3.14)
- Utilities (Section 3.15)
- Community Services (Section 3.16)
- Socioeconomics (Section 3.17)
- Environmental Justice (Section 3.18)

Each section begins with an introduction to the resource, including a description of the applicable ROI, the method to analyze potential impacts, and important factors considered in the analysis. Each introduction is followed by a description of the affected environment (baseline conditions) for the resource, a description of the direct and indirect impacts of the Proposed Action, and a description of the direct and indirect impacts of the No Action Alternative.

3.0.2 Characterization of Potential Impacts

Where possible, potential impacts associated with the Proposed Action and the No Action Alternative are quantified. Often, it is not possible to quantify impacts; therefore, a qualitative assessment of potential impacts is presented. The following descriptors are used qualitatively to characterize impacts on respective resources:

- ***Beneficial*** – Impacts would improve or enhance the resource.
- ***Negligible*** – No apparent or measurable impacts would be expected; may also be described as "none" if appropriate.
- ***Minor*** – The action would have a barely noticeable or measurable adverse impact on the resource.
- ***Moderate*** – The action would have a noticeable or measurable adverse impact on the resource. This category could include potentially significant impacts that would be reduced to a lesser degree by the implementation of mitigation measures.
- ***Substantial*** – The action would have obvious and extensive adverse effects that could result in potentially significant impacts on a resource despite mitigation measures.

Additionally, impacts may consist of direct or indirect effects:

- ***Direct impacts*** are defined as those caused by the action and occurring at the same time and place. Examples include habitat destruction, soil disturbance, air emissions, and water use.
- ***Indirect impacts*** are defined as those caused by the action, but occurring later in time or farther removed in distance from the action. Examples include changes in surface water quality resulting from soil erosion, and alteration of wetlands resulting from changes in surface water quantity.

Context and intensity are taken into consideration in determining a potential impact's significance as defined in 40 CFR 1508.27. The context of an impact takes into account the ROI, the affected interests, and the locality. For example, a site-specific action is more likely to have a significant effect on the immediate environment or population within the ROI, than on a wider geographic region. However, some aspects, such as GHG emissions, may have implications for a broader geographic area (e.g., global). The intensity of a potential impact refers to the severity of the impact and should consider the following aspects: beneficial and adverse impacts; the degree of effects on public health and safety; the proximity of, and degree to which actions may adversely impact, protected features or unique characteristics of the geographic area (e.g., protected species and their habitats, cultural resources, wetlands, prime farmland, park lands, wild and scenic rivers); the levels of public and scientific controversy associated with a project's impacts; the degree of uncertainty about project impacts or risks; whether the action establishes a precedent for future actions with significant effects; whether related or connected actions have been appropriately considered in the analysis of impacts; or whether the action threatens to violate federal, state, or local law, or requirements imposed for protection of the environment.

3.1 AIR QUALITY AND CLIMATE

3.1.1 Introduction

This section describes existing air quality in the region potentially affected by the construction and operation of the Mountaineer CCS II Project and analyzes potential effects from this project on air quality. This section also provides information on the climate and the potential for severe weather events in the region of the project, including a discussion of the predominant wind patterns in the context of dispersion of air emissions.

The current project design specifies that an exhaust slipstream would be diverted from the existing power plant flue gas and treated by the CAP for CO_2 removal. The treated flue gas would then be returned to the existing power plant exhaust stack (see Section 2.3.3.2). In addition to removing CO_2, the CAP process is also expected to reduce or remove other emissions (e.g., sulfur oxides [SO_x]) from the slipstream, resulting in an overall reduction of emissions from the existing Mountaineer Plant stack.

3.1.1.1 Region of Influence

The ROI for air quality includes the current Mountaineer Plant footprint (including the proposed CO_2 capture facility) and areas within 30 miles of this boundary, including the CO_2 pipeline corridors and injection well sites. This ROI represents the distance to which most steady-state Gaussian plume models are considered accurate for setting emission limits and is the distance currently recommended by EPA for "near-field" analyses. DOE analyzed the potential air quality impacts associated with the Mountaineer CCS II Project based on the estimated physical characteristics, expected rate, and duration of emissions.

3.1.1.2 Method of Analysis

The air quality analysis included modeling of estimated project emissions of criteria air pollutants to determine potential changes to ambient air quality in relation to the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments. This analysis also included an estimation of potential NH_3 emissions and associated secondary particulate formation.

Available ambient air quality data were obtained from monitoring stations in the region and analyzed to derive representative baseline air concentrations for pollutants of interest. DOE considered the following factors:

- Proximity of monitoring stations to the project site
- Representativeness of monitor locations relative to the project site
- Availability of specific pollutant data
- Availability of the most recent data

DOE assessed potential impacts of air emissions associated with the construction and operation of the Mountaineer CCS II Project based on estimated emission concentrations, durations, locations, and source types. DOE considered emissions from the existing Mountaineer Plant as part of the baseline air quality conditions. DOE compared existing and predicted stack exhaust to assess if predicted changes in emission characteristics (e.g., temperature and volume) could result in potential differences in plume behavior.

3.1.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to air quality based on whether the Mountaineer CCS II Project would directly or indirectly

- result in emissions of criteria pollutants or hazardous air pollutants (HAPs);

- modify the current baseline emissions profile and effluent conditions of the existing Mountaineer Plant exhaust;
- cause an adverse change in air quality related to the NAAQS or West Virginia Ambient Air Quality Standards (WVAAQS);
- result in degradation of air quality greater than the PSD increments and the requirements of New Source Review (NSR) per Title 1 of the Clean Air Act (CAA) 45 CFR 52.21 and West Virginia Code of State Rules (CSR) 45 CSR 8;
- affect visibility and regional haze in Class I areas within the ROI;
- result in nitrogen and sulfur deposition in Class I areas; or
- conflict with local or regional air quality management plans to attain or maintain compliance with the NAAQS and WVAAQS.

3.1.2 Affected Environment

Federal and State Air Quality Regulations

The CAA requires that the EPA establish NAAQS to protect public health and the public welfare (42 USC 7409). Accordingly, EPA developed primary and secondary ambient air quality standards for six criteria pollutants: SO_2, carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb), and particulate matter (PM). Two PM standards have been promulgated: the PM_{10} standard covers particles with aerodynamic diameters of 10 micrometers or less, and the $PM_{2.5}$ standard covers particulates with aerodynamic diameters of 2.5 micrometers or less. The NAAQS are expressed as concentrations of the criteria pollutants in the ambient air; that is, in the outdoor air to which the public has access [40 CFR 50.1(e)]. Primary standards are set to protect the public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The CAA requires states to develop federally approved regulatory programs, called State Implementation Plans (SIPs), for meeting the NAAQS throughout the state. The WVDEP Division of Air Quality is responsible for improving and monitoring air quality in West Virginia for each of the criteria pollutants and assessing compliance.

Areas that meet the NAAQS for a criteria pollutant are designated as being in "attainment" for that pollutant. Areas where a criteria pollutant concentration exceeds the NAAQS are designated as "nonattainment" areas. Where insufficient data exist to determine an area's attainment status, the area is designated as unclassifiable. Maintenance areas are those that were once designated as nonattainment areas but are now in attainment and are under a 10-year monitoring plan to maintain their attainment status. Table 3.1-1 lists the NAAQS.

The West Virginia Ambient Air Quality regulation (45 CSR 8) also contains an anti-degradation policy with a stated objective to maintain the cleanest air quality possible within the state by protecting the difference between the present air quality and the applicable standards by requiring new sources to control their emissions and not increase ambient pollutant concentrations above prescribed incremental concentrations. Specifically the policy states the following:

> *§45-8-2. Anti-Degradation Policy*
>
> *2.1. Pursuant to the best interests of the State of West Virginia, it is the objective of the Secretary to obtain and maintain the cleanest air possible, consistent with the best available technology.*

Table 3.1-1. National Ambient Air Quality Standards

Pollutant	Primary Standards	Averaging Times	Secondary Standards
CO	9 ppm (10 mg/m^3)	8-hour[a]	none
	35 ppm (40 mg/m^3)	1-hour[a]	none
NO_2	0.053 ppm (100 µg/m^3)	annual (arithmetic mean)	same as primary
	0.1 ppm	1-hour[b]	none
O_3	0.075 ppm (2008)	8-hour[c]	same as primary
	0.08 ppm (1997)	8-hour[d]	same as primary
	0.12 ppm	1-hour[e] (applies only in limited areas)	same as primary
Pb	0.15 µg/m^3	rolling 3-month average[f]	same as primary
	1.5 µg/m^3	quarterly average	same as primary
PM_{10}	150 µg/m^3	24-hour[g]	same as primary
$PM_{2.5}$	15.0 µg/m^3	annual[h] (arithmetic mean)	same as primary
	35 µg/m^3	24-hour[i]	same as primary
SO_2	0.03 ppm	annual (arithmetic mean)	same as primary
	0.14 ppm	24-hour[a]	same as primary
	0.075 ppm[j]	1-hour	0.5 ppm (1300 µg/m^3); 3-hour[a]

Sources: 40 CFR 50; EPA, 2010a; WVDEP, 2010a

[a] Not to be exceeded more than once per year.

[b] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.1 ppm (effective January 22, 2010).

[c] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

[d] (1) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(2) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 O_3 standard to the 2008 O_3 standard.

(3) The EPA is in the process of reconsidering these standards (set in March 2008).

[e] (1) As of June 15, 2005, the EPA revoked the 1-hour O_3 standard in all areas except the fourteen 8-hour O_3 nonattainment Early Action Compact (EAC) Areas.

(2) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1, as determined by Appendix H.

[f] Final rule signed October 15, 2008.

[g] Not to be exceeded more than once per year on average over 3 years.

[h] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[i] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

[j] Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.075 ppm.

CO = carbon monoxide; mg/m^3 = milligram per cubic meter; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; ppm = parts per million; SO_2 = sulfur dioxide; µg/m^3 = microgram per cubic meter

2.2. Where the present ambient air is of better quality than the established standards, the Secretary will develop long-range plans to protect the difference between the present quality and the established standards. The plans will be based upon the best available forecasts of probable land and air uses in these areas of high air quality.

2.3. The air quality of these areas will not be lowered unless it has been clearly demonstrated to the Secretary that such a change is justifiable as a result of necessary economic or social development and will not result in statutory air pollution. This will require that any industrial, public, or private project or development which could constitute a new source of air pollutants, within an area of such high air quality, provide the best practicable control available under existing technology as part of the initial project or development.

2.4. The promulgation of primary and secondary ambient air quality standards shall not be considered in any manner to allow significant deterioration of existing air quality in any portion of West Virginia.

This policy is consistent with the federal requirements codified in 40 CFR 52.21 regarding the PSD rule. Prevention of deterioration of existing air quality levels is limited by the amount of additional or incremental concentration that is allowed to increase above a baseline concentration. Increases that would lead to violations of the standards are not allowed. The allowable concentration increases for each pollutant and the averaging period are referred to as the allowable PSD increments, and are specific to the classification of the area.

The PSD requirements provide for a system of area classifications that affords states an opportunity to identify local land use goals. There are three area classifications. Each classification differs in terms of the amount of growth it would permit before significant air quality deterioration would be deemed to occur. Class I areas have the smallest increments and thus allow only a small degree of air quality deterioration. Class II areas can accommodate normal well-managed industrial growth. Class III areas have the largest increments and thereby provide for a larger amount of development than either Class I or Class II areas. Congress established certain areas (e.g., wilderness areas and national parks) as mandatory Class I areas. These areas cannot be redesignated to any other area classification. All other areas of the country were initially designated as Class II. Procedures exist under the PSD regulations to redesignate the Class II areas to either Class I or Class III, depending on a state's land management objectives (EPA, 1990).

The location of the Mountaineer CCS II Project would be designated as Class II. There are two Class I areas in West Virginia; however the closest Class I area is more than 100 miles from the project and well beyond the expected ROI of the project's potential impact area. Table 3.1-2 lists the allowable increment concentrations for each classification.

Table 3.1-2 also lists the modeling significant impact level concentrations for both classifications. These concentrations represent the level at which predicted maximum impacts from a source are considered to be significant for analysis purposes, for each pollutant and averaging period. Predicted impacts below these concentrations are generally considered insignificant, thus additional analyses would not be required. Predicted maximum impacts above these levels may require additional analyses to determine cumulative impacts that demonstrate compliance with the applicable ambient air quality standards and PSD increments.

Existing Air Quality

The Mountaineer CCS II Project site would be located in Mason County, West Virginia, which is along the southeastern border of the State of Ohio. The WVDEP Division of Air Quality, Air Monitoring Section, and the Ohio Environmental Protection Agency, Division of Air Pollution Control, have established ambient air quality monitoring sites throughout West Virginia and Ohio, respectively, to monitor compliance with the NAAQS.

Table 3.1-2. National and West Virginia Ambient Air Quality Standards, Prevention of Significant Deterioration Increments, and Significant Impact Levels (μg/m³)

Criteria Pollutant	Averaging Period	NAAQS	WVAAQS	PSD Increments		Significant Impact Level	
				Class I	Class II	Class I	Class II
CO	8–hour	10,000[b]	10,000[b]				500
	1-hour	40,000[b]	40,000[b]				2000
NO_2	annual	100[a]	100[a]	2.5[a]	25.0[a]	0.1	1.00
	1-hour	188[d]					7.5[e]
O_3	8-hour	147[j]	147[j]				
	1-hour	235[k]					
Pb	quarterly	0.15[a]	0.15[a]				
PM_{10}	annual			4[a]	17.0[a]	0.2	1.00
	24-hour	150[f]	150[f]	8[b]	30.0[b]	0.3	5.00
$PM_{2.5}$	annual	15[g]	15[g]	1[h]	4-5[h]	0.6-0.16[h]	0.3-1.0[h]
	24-hour	35[i]	35[i]	2[h]	9[h]	0.07-0.24[h]	1.2-5[h]
SO_2	annual	80.0[a]	80.0[a]	2[a]	20.0[a]	0.1	1.00
	24-hour	365[b]	365[b]	5[b]	91.0[b]	0.2	5.00
	3-hour	1300[b]	1300[b]	25[b]	512[b]	1.0	25.0
	1-hour	195[c]					

Sources: 40 CFR 50, 51, and 52.21, and 45 CSR 8

[a] Not to be exceeded.

[b] Not to be exceeded more than once per year.

[c] Three-year average of the 99th percentile of the daily maximum 1-hour average, not to be exceeded.

[d] Three-year average of the 98th percentile of the daily maximum 1-hour average, not to be exceeded.

[e] Interim 4 parts per billion significant impact level recommended by EPA in a June 29, 2010 Memorandum: Guidance Concerning the Implementation of the 1-hr NO_2 NAAQS for the PSD Program.

[f] Fourth highest concentration in the prior 3 calendar years, not to be exceeded.

[g] Three-year arithmetic mean of concentrations from single or multiple community-oriented monitors, not to be exceeded.

[h] Proposed on 9/21/07, 40 CFR 51 and 52.

[I] Average 98th percentile of the measured concentrations over 3 years, not to be exceeded.

[j] Three-year average of the annual 4th highest daily maximum 8-hour average, not to be exceeded.

[k] Not to be exceeded more than once per year on average. Revoked in most areas.

Note: Shaded cells indicate no levels provided.

CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide; WVAAQS = West Virginia Ambient Air Quality Standards; μg/m³ = microgram per cubic meter

According to the WVDEP, sampling sites are located to assess ambient air quality levels based on population exposure, industry emissions, determining compliance with the NAAQS, background levels and other special purposes (WVDEP, 2009a). Nearly all air quality monitoring equipment is located at permanent sites, in buildings or shelters designed for monitoring purposes.

The data collected are used by the WVDEP Division of Air Quality to implement programs to ensure attainment of NAAQS. Table 3.1-3 lists the number of monitoring locations in each county for calendar year 2009, and the pollutants monitored at each location.

As can be seen from the list in Table 3.1-3, there are no air quality monitoring sites in Mason County; therefore existing air quality for the area must be determined from nearby monitoring stations that are considered representative of air quality of the general region, including monitoring stations in the neighboring regions of Ohio.

Table 3.1-3. Number of West Virginia Monitoring Locations by County

County	Air Toxics	CO	Met	O_3	PM_{10}	$PM_{2.5}$	SO_2
Berkeley				1		1	
Brooke	1	1			2	2	3
Cabell	1			1		1	1
Greenbrier				1			
Hancock		2	1	1	2	1	6
Harrison						1	
Kanawha	1			1	1	2	1
Marion						1	
Marshall						1	1
Monongalia	1			1		1	1
Ohio	1			1	1	1	
Raleigh						1	
Wood	1			1		1	1
Total Sites	6	3	1	8	6	14	14

Source: WVDEP, 2009a

Note: Gray-shaded cells indicate no data available.

CO = carbon monoxide; Met = meteorological; O_3 = ozone; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide

Consideration of the available monitoring stations in West Virginia and Ohio resulted in the selection of appropriate stations that DOE considered representative of air quality levels or background levels within the 30-mile ROI and the area of the project. Figure 3.1-1 illustrates the regional monitoring locations and the project site. Table 3.1-4 presents the corresponding background concentrations at these stations for the most recent 4 years of readily available data.

Mason County has been designated unclassifiable or in attainment of all NAAQS, except $PM_{2.5,}$ (40 CFR 81.349), for which it has been designated as partial nonattainment with the $PM_{2.5}$ standard for the Graham Tax District area. The Graham Tax District encompasses an approximately 25 square mile area, which includes the Mountaineer and Philip Sporn electric generating plants. The Graham Tax District has no air monitoring stations to measure $PM_{2.5}$ and is not adjacent to any other nonattainment areas. The nonattainment designation is based solely on the presence of the two major stationary sources and the assertion that these sources significantly cause or contribute to regionally transported emissions impacting downwind $PM_{2.5}$ nonattainment areas.

Because the project would be within a $PM_{2.5}$ nonattainment area, federal actions within this area must show conformity with the SIP, and the project would fall under the General Conformity Rule; however, according to federal and state regulations (40 CFR 93.153, 45 CSR 35, and 45 CSR 19) DOE would not need to demonstrate SIP conformity if the total direct and indirect emissions would be less than the criteria thresholds showed in Table 3.1-5.

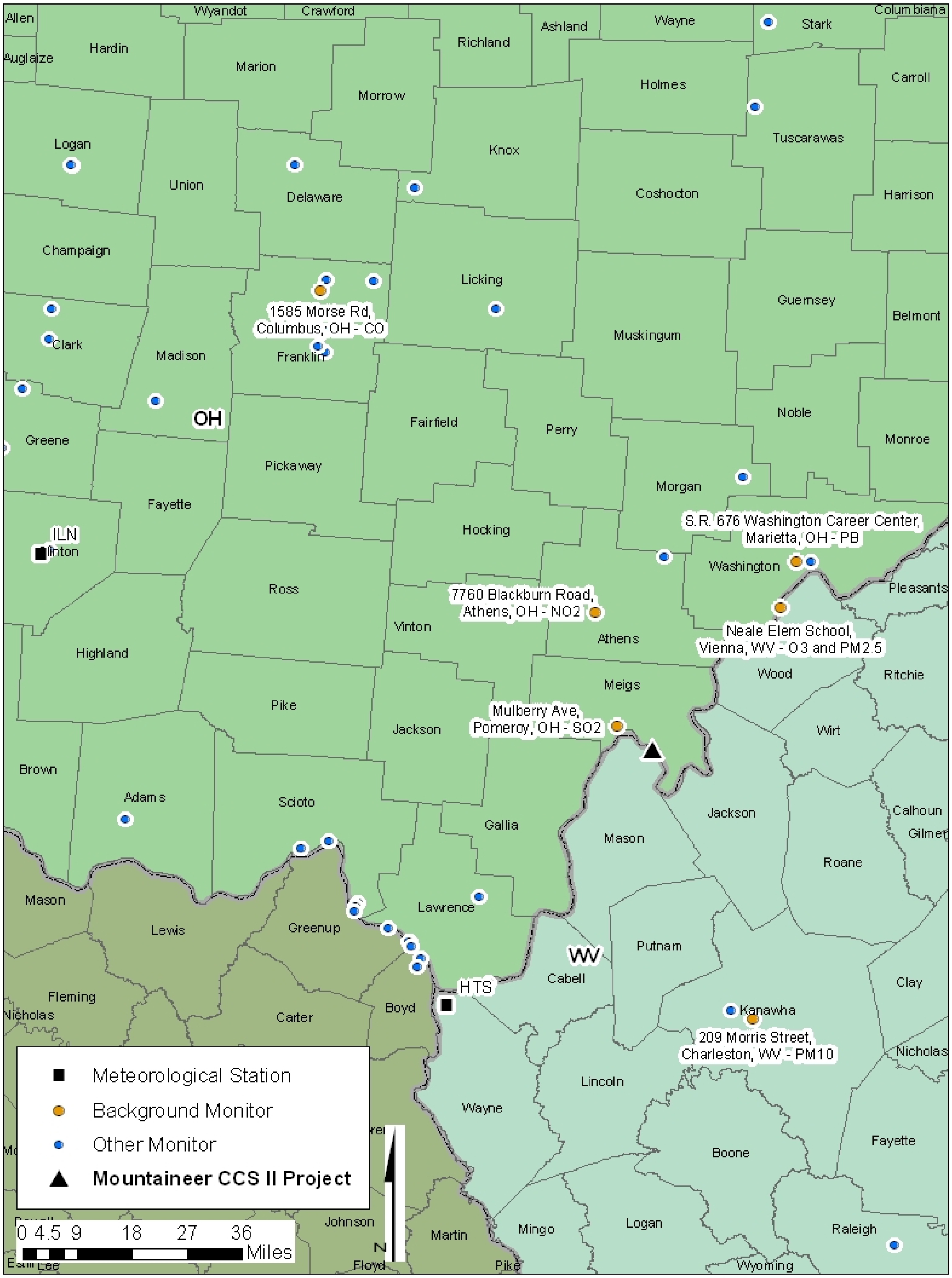


Figure 3.1-1. Locations of Ambient Air Quality Monitoring Stations near the Project Site Area

Sources: EPA, 2010b and EPA, 2010c

Table 3.1-4. Criteria Pollutant Averaging Period, NAAQS, and Background Concentrations from Representative Monitor Locations

Criteria Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	Background Concentration[a] ($\mu g/m^3$)				Monitor Location
			2006	2007	2008	2009	
CO	1-hour	40,000	**3314**	2629	2629	2514	585 Morse Rd., Columbus, Franklin County, Ohio, 93 miles northwest of project site
	8-hour	10,000	**2333**	1778	1556	1667	
NO_2[b]	1-hour	188		75.2	**120.3**	67.7	7760 Blackburn Road, Athens, Athens County, Ohio, 24 miles north-northwest of project site
	annual	100		**9.4**	**9.4**	7.9	
O_3	8-hour	147	156.8	**164.6**	139.2	119.6	Neale Elementary School, Vienna, Wood County, West Virginia, 31 miles northeast of project site
Pb	quarterly	0.15	**0.01**	**0.01**	**0.01**	**0.01**	SR 676, Washington Career Center, Marietta, Washington County, Ohio, 39 miles north-northeast of project site
PM_{10}	24-hour	150	**79.0**	53.0	51.0	48.0	209 Morris Street, Kanawha County, Charleston, West Virginia, 47 miles southeast of project site
	annual	50	22.0	**23.0**	22.0	18.4	
$PM_{2.5}$[c]	24-hour	35	35.1	**38.8**	34.7	27.9	Neale Elementary School, Vienna, Wood County, West Virginia, 31 miles northeast of project site
	annual	15	14.7	**15.3**	14.7	12.1	
SO_2	1-hour	195	**283**	218	203	244	Mulberry Avenue, Pomeroy, Meigs County, Ohio, 7 miles northwest of project site
	3-hour	1,300	**237**	166	148	**237**	
	24-hour	365	**57.4**	52.1	49.5	**57.4**	
	annual	80	**13.3**	10.7	10.7	8.3	

Sources: EPA, 2010b; EPA, 2010c; 40 CFR 50; and OEPA, 2010a

[a] Highest, second-highest short-term (1-, 3-, 8- & 24-hour), and maximum annual average concentrations presented, except for 8-hour O_3, which is the fourth highest 8-hour concentration rounded to the nearest 0.01 ppm, 24-hour $PM_{2.5}$, which is the 98th percentile, 1-hour SO_2, which is the 99th percentile value, and 1-hour NO_2, which is the highest 1-hour averaged value.

[b] 2006 Values not available for closest monitor.

[c] Twenty-four hour value for 2009 is 99th percentile value as data source for 2009 did not provide 98th percentile value.

Note: A **bolded value** identifies the greatest value over the 3-year period and is presented as being a representative or conservative background concentration for the study area. A gray-shaded cell indicates no data available.

$\mu g/m^3$ = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; SR = state route

Table 3.1-5. Threshold Rates Requiring Conformity Determination in $PM_{2.5}$ Nonattainment Areas

Criteria Pollutant	Emission Rate (tpy)
O_3 (VOCs or NO_x)	100[a]
CO	100
SO_2 and NO_2	100
PM_{10}	100[b]
$PM_{2.5}$ direct emissions	100
SO_2	100
NO_x (unless determined not to be significant precursors to $PM_{2.5}$)[c]	100
VOCs or ammonia (not applicable, unless determined to be significant precursors to $PM_{2.5}$)[d]	100
Pb	25

Source: 40 CFR 93.153(b)(1); West Virginia 45 CSR 35; West Virginia 45 CSR 19

[a] Thresholds vary based on severity of nonattainment. Threshold shown for areas outside O_3 transport region.

[b] Threshold for serious nonattainment area is 70.

[c] West Virginia 45 CSR 19 (2.61.c.3) states NO_x are presumed to be precursors to $PM_{2.5}$ in all $PM_{2.5}$ nonattainment areas unless demonstrated that emissions of NO_x from sources in a specific area are not a significant contributor to that area's ambient $PM_{2.5}$ concentrations.

[d] West Virginia 45 CSR 19 (2.61.c.4) states VOCs and ammonia are presumed NOT to be precursors to $PM_{2.5}$ in any $PM_{2.5}$ nonattainment areas unless demonstrated that emissions of VOCs or ammonia from sources in a specific area are a significant contributor to that area's ambient $PM_{2.5}$ concentrations.

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; O_3 = ozone; Pb = lead; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

Climate and Meteorology

The Huntington Tri-State Airport (HTS) National Weather Service Station in Huntington, West Virginia, was chosen as being climatologically representative of the project site. HTS is approximately 54 miles southwest of the Mountaineer CCS II Project site and is the closest station with readily available climatological data. The climate data are summarized on a regular basis by the National Climatic Data Center (NCDC) (NCDC, 2009).

The climate normals reported by NCDC include the period of record from 1971 through 2000 for HTS. A selection of temperature normals are presented in Table 3.1-6. Temperatures range from a normal daily minimum of 24.5°F in January to a normal daily maximum of 85.1°F in July, characteristic of moderately cold winters and warm summers. Extreme cold and warm temperatures are also possible in the area as highest daily maximum value is 103°F and the lowest daily minimum -21°F. Relative humidity (a measure of atmospheric water vapor content) tends to be high along the Ohio River, as normal relative humidity values range from 74 to 77 percent in the summer months of June, July, and August. In the winter months of December, January, and February the normal relative humidity ranges from 67 to 71 percent (NCDC, 2009).

Precipitation is fairly evenly distributed throughout the year at HTS as presented in Table 3.1-7. The maximum and minimum normal monthly values of 4.46 inches and 2.73 inches occur in August and October, respectively. HTS also experiences measurable snowfall in the winter months with the maximum normal monthly snowfall of 8.9 inches being in January (NCDC, 2009).

Table 3.1-6. Temperature Normals for the Huntington Tri-State Airport National Weather Service Station, Period of Record, 1971 through 2000

Period	Temperature (°F)		
	Normal Daily Maximum	Normal Daily Minimum	Normal Dry Bulb
January	41.0	24.5	32.7
February	46.1	27.5	36.8
March	56.3	35.5	45.9
April	66.6	43.7	55.2
May	74.6	52.6	63.6
June	81.7	60.9	71.3
July	85.1	65.4	75.3
August	83.7	64.1	73.9
September	77.0	56.8	66.9
October	66.4	44.8	55.6
November	55.1	36.6	45.9
December	45.3	28.9	37.1
Annual	64.9	45.1	55.0

Source: NCDC, 2009
°F = degrees Fahrenheit

Table 3.1-7. Normal Precipitation for the Huntington Tri-State Airport National Weather Service Station, Period of Record, 1971 through 2000

Period	Normal Precipitation (inches)
January	3.21
February	3.09
March	3.83
April	3.33
May	4.41
June	3.88
July	4.46
August	3.88
September	2.80
October	2.73
November	3.32
December	3.37
Annual Total	42.31

Source: NCDC, 2009

Typical wind speed and direction for HTS is represented by a wind rose generated using hourly meteorological data from 1991 through 1995 and presented in Figure 3.1-2. The years 1991 to 1995 were chosen as they are the most recent, readily available, and appropriate surface observation data. These readily available wind data were previously formatted using the meteorological data preprocessor AERMET (EPA, 2010d).

The percent values shown in Figure 3.1-2 represent the amount of time over the 5-year dataset that the wind blows from a particular direction. The predominant wind directions for HTS are from the southwest, with significant winds also present at times from the west-southwest and west. A frequency distribution of the wind speed and direction presented in Table 3.1-8 show the predominant wind direction as southwest with remaining hours spread relatively evenly in each direction. The most frequently occurring wind speed is moderately low between 4.7 to 8.1 miles per hour.

DOE gathered severe weather data for Mason County, West Virginia, using the NCDC Storm Events Database for the available period of record of January 1, 1950 through April 30, 2010 (NCDC, 2010). Since July 1968, 3 tornados and 78 thunderstorm or lightning events were recorded. This averages to less than two recorded severe thunderstorm events per year. Thirty-nine hail events were recorded, beginning in August 1983, which averages to less than two hail events per year. Most hail diameters recorded during these events were less than 1 inch. Twenty severe winter weather events, including snow, heavy snow, blizzard, ice storm, or winter storm events were recorded since February 1993, which averages to just over one severe winter storm event per year in Mason County (NCDC, 2010).

3.1.3 Direct and Indirect Impacts of the Proposed Action

3.1.3.1 Construction Impacts

DOE estimated potential emissions associated with construction of the project. Emission estimates for the pipelines and injection well sites have been developed to correspond to a per-mile and per-well basis, respectively.

DOE calculated construction-related emissions by considering the estimated area and duration of land disturbance, likely construction equipment and operating schedules, estimated number of construction worker vehicle trips, and transport method, and quantities of material deliveries and waste removal. Based on this information, DOE estimated construction equipment emissions using reference emission factors and load rates from EPA's NONROAD model (EPA, 2005; EPA, 2008). DOE estimated vehicle emissions based on class designations and reference emission rates from MOBILE6 (EPA, 2003). The equipment horsepower ratings were obtained from available vendor data or based on reasonable estimates. Fugitive dust emissions, classified as PM_{10} and $PM_{2.5}$, were estimated using an emission factor of 0.11 tons per acre per month for PM_{10}, and a $PM_{2.5}/PM_{10}$ ratio of 0.1 (WRAP, 2006). The resulting estimates for these emissions should be considered conservative based on the factors used, and the use of conservative estimates for the size of area disturbed and the duration of activities.

CO_2 Capture Facility

The CO_2 capture facility would be constructed within a 33-acre parcel inside the existing 450-acre Mountaineer Plant property. Figure 2-5 illustrates the proposed site area. This area is within the existing Mountaineer Plant property, with buffering space of at least 800 feet to the closest property fence-line boundary. Overall construction of the CO_2 capture facility is estimated to take 32 months, of which 18 months would involve land-disturbing activities and approximately 8 months of facility commissioning. Less construction activity would be expected during the commissioning phase than during the actual construction phase. Construction of the proposed upgrades to the existing barge unloading area would be expected to occur over a 2-week period and would only be used during construction of the CO_2 capture facility.

DOE used AEP's preliminary monthly construction schedule and associated activity levels of expected construction equipment to calculate the potential emissions during the construction of the CO_2 capture facility. DOE calculated both tailpipe emissions originating from the construction equipment and fugitive dust emissions generated in the construction area. Table 3.1-9 summarizes the calculated annual criteria pollutant emissions.

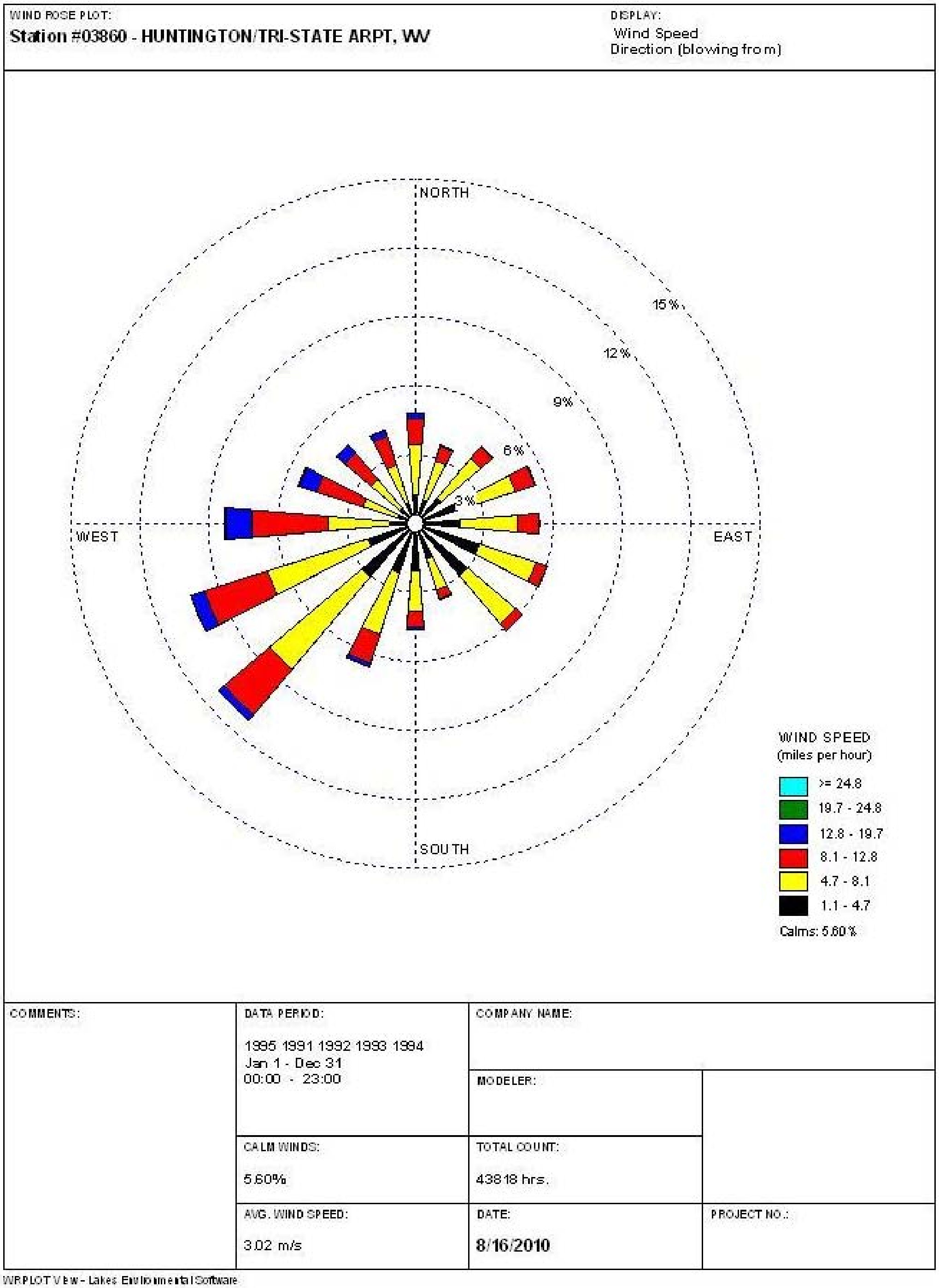


Figure 3.1-2. Wind Rose for the Huntington Tri-State Airport National Weather Service Station, 1991-1995

Table 3.1-8. Frequency of Hours per Wind Class for the Huntington Tri-State Airport National Weather Service Station, 1991-1995

Directions (degrees)	Directions (Cardinal)	Wind Class (miles per hour)						Frequency (percent)
		1.1 - 4.7	4.7 - 8.1	8.1 - 12.8	12.8 - 19.7	19.7 - 24.8	>=24.8	
348.75 - 11.25	N	1.25	2.20	1.10	0.24	0.01	0.00	4.81
11.25 - 33.75	NNE	1.08	1.79	0.66	0.06	0.01	0.00	3.60
33.75 - 56.25	NE	1.47	2.27	0.66	0.03	0.00	0.00	4.42
56.25 - 78.75	ENE	1.91	2.66	0.88	0.05	0.00	0.00	5.50
78.75 - 101.25	E	1.94	2.51	0.90	0.05	0.00	0.00	5.40
101.25 - 123.75	ESE	2.92	2.59	0.49	0.03	0.00	0.00	6.02
123.75 - 146.25	SE	2.96	2.78	0.36	0.03	0.00	0.00	6.13
146.25 - 168.75	SSE	1.61	1.42	0.40	0.04	0.01	0.00	3.47
168.75 - 191.25	S	2.07	1.73	0.69	0.12	0.01	0.00	4.62
191.25 - 213.75	SSW	2.26	2.80	1.32	0.17	0.01	0.00	6.55
213.75 - 236.25	SW	3.05	5.27	2.55	0.32	0.01	0.00	11.20
236.25 - 258.75	WSW	2.17	4.58	2.86	0.61	0.02	0.00	10.24
258.75 - 281.25	W	1.12	2.69	3.29	1.14	0.06	0.01	8.31
281.25 - 303.75	WNW	0.83	1.56	2.10	0.80	0.06	0.01	5.35
303.75 - 326.25	NW	0.86	1.66	1.48	0.48	0.02	0.01	4.51
326.25 - 348.75	NNW	0.92	1.75	21.04	0.28	0.02	0.00	4.28
All Directions		28.43	40.24	21.04	4.45	0.22	0.03	94.39
Calms								6.00
Total								100.00

Source: NCDC, 2009

E = east; ENE = east northeast; ESE = east southeast; N = north; NE = northeast; NNE = north northeast; NW = northwest; NNW = north northwest; S = south; SE = southeast; SSE = south southeast; SSW = south southwest; SW = southwest; W = west; WSW = west southwest; WNW = west northwest

Table 3.1-9. Estimated CO_2 Capture Facility Construction Emissions

Pollutant	Tailpipe Emissions[a] (tons)	Fugitive Dust Emissions[b] (tons)	Total (tons)
CO	32.7		32.7
NO_x	60.5		60.5
PM_{10}[c,d]	4.1	65.3	69.4
$PM_{2.5}$[c]	4.1	6.5	10.6
SO_2	0.2		0.2
VOCs	5.3		5.3

[a] Tailpipe emissions based on construction period of 32 months.

[b] Fugitive dust emissions estimates based on 33 acres of land disturbance over an 18-month period.

[c] $PM_{2.5}$ is a subset of PM_{10}.

[d] Lead is a subset of PM_{10}.

Note: Gray-shaded cells indicate non-applicability.

CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

Pipelines Corridors

Construction of the CO_2 pipeline within the potential corridors would be accomplished with typical construction methods and within a construction easement of 80 to 120 feet wide as described in Section 2.3.4.3. DOE calculated both tailpipe emissions originating from the construction equipment and fugitive dust emissions generated in the construction area from mechanical disturbance of the surface and excavated material. DOE estimated potential emissions during construction based on the length of the pipeline corridors, area disturbed, and expected level of activity. Table 3.1-10 summarizes the calculated emissions for the various pipeline routes under consideration by AEP.

Table 3.1-10. Estimated Pipeline Construction Emissions

Potential Injection Well Property	Pipeline Route Options	Length (miles)	Tailpipe Emissions[a] (tons)						Fugitive Dust Emissions (tons)	
			CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOCs	PM_{10}	$PM_{2.5}$
Borrow Area	Borrow Area Route	2.2	1.2	2.9	0.2	0.2	<0.1	0.3	2.2	0.2
Eastern Sporn Tract	Eastern Sporn Route 1	5.0	2.6	6.4	0.4	0.4	<0.1	0.6	4.8	0.5
	Eastern Sporn Route 2	8.2	4.3	10.5	0.7	0.7	<0.1	0.9	7.9	0.8
	Eastern Sporn Route 3	5.1	2.7	6.6	0.4	0.4	<0.1	0.6	4.9	0.5
	Eastern Sporn Route 4	8.7	4.5	11.1	0.7	0.7	<0.1	1.0	8.3	0.8
Jordan Tract	Jordan Route 1	9.2	4.8	11.9	0.8	0.8	<0.1	1.0	8.9	0.9
	Jordan Route 2	9.2	4.8	11.9	0.8	0.8	<0.1	1.0	8.9	0.9
	Jordan Route 3	9.7	5.1	12.4	0.8	0.8	<0.1	1.1	9.3	0.9
	Jordan Route 4	9.7	5.1	12.4	0.8	0.8	<0.1	1.1	9.3	0.9
Western Sporn Tract	Western Sporn Route	5.7	3.0	7.3	0.5	0.5	<0.1	0.6	5.5	0.6

[a] Fugitive dust emission estimates based on land disturbance occurring in a 120-foot ROW, during an average construction time of 1.7 miles of pipeline/month. $PM_{2.5}$ is a subset of PM_{10}.

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

Injection Well Sites

DOE calculated both exhaust emissions originating from the construction and drilling equipment and fugitive dust emissions generated in the construction area. Construction of the injection wells would require approximately 5 acres per well or co-located cluster of two wells. Therefore, to be conservative, DOE calculated the potential air emissions from construction assuming that 5 acres would be disturbed for each well. Access roads to the injection wells would predominantly be located within this 5-acre area, except for the access roads to Injection Wells ES-2 and BA-1, which would extend outside this area. In addition to the construction area emissions, DOE calculated the potential emissions from the drilling rig assumed to operate continuously at each injection well site while drilling. Other equipment assumed to be operating at the well construction area and included in the emission calculations are bulldozers, skid steer lifts, pumps, diesel generators, welders rig, mechanics rig, service vehicles, and delivery vehicles. A summary of the estimated emissions from these construction activities are summarized in Table 3.1-11.

Table 3.1-11. Estimated Well Construction Emissions per Injection Well

Pollutant	Tailpipe Emissions[a] (tons)	Fugitive Dust Emissions[b,c] (tons)	Total (tons)
CO	13.0		13.0
NO_x	32.6		32.6
PM_{10}	1.7	1.1	2.8
$PM_{2.5}$	1.7	0.1	1.8
SO_2	≤ 0.1		≤ 0.1
VOCs	2.4		2.4

[a] Tailpipe emissions based on average drilling period of 4 months.

[b] Fugitive dust emission estimates are based on 5 acres of land disturbance over a 2-month period.

[c] The access roads would be predominantly within this 5-acre area of disturbance for all potential injection well locations (except for the access roads to ES-2 and BA-1). Thus the estimates for PM emissions include disturbance during construction of the access roads. PM emissions for the access roads would amount to less than 0.003 tons for ES-2, and less than 0.001 tons for BA-1.

Note: Gray-shaded cells indicate non-applicability.

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

AEP would likely be required by WVDEP to install monitoring wells as part of the UIC permitting process for this project (see Section 2.3.5.2). The quantity and location of the monitoring wells would be determined in the final UIC permit, based in part on the results of the geologic characterization work. AEP anticipates the need for one to three monitoring wells per injection well, or per co-located pair of injection wells. Construction of monitoring wells would be completed using similar methods as the injection wells and could disturb up to 5 acres for each well. Potential impacts would be similar to those described for the construction of the injection wells.

Total Construction Emissions

Tables 3.1-9 through 3.1-11 present the estimated construction emissions for the project. The total calculated emissions are based on the preliminary project design and conservative assumptions regarding activity levels and duration, and therefore calculated total emissions are likely overestimates of actual potential emissions. The construction activities may occur over a 32-month period for the CO_2 capture facility, with land-disturbing activities generally occurring over an 18-month period. Construction durations and related emissions for the pipelines and injection wells would be dependent upon the miles of pipeline and number of injection well sites that are ultimately needed. Construction duration and emissions would be greater with pipeline distance and the number of injection well sites. Emissions from all of these sources would be short term in nature, and would be expected to have only a minor impact on local air quality. Table 3.1-12 presents a lower-bound scenario where injection wells would only be required at the Mountaineer Plant and Borrow Area, and an upper-bound (worst-case) scenario where injection wells would be required at the Borrow Area, Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract locations.

Fugitive dust emissions consisting of larger particulates would be greatest during land-disturbance activities, and would generally deposit within several hundred feet of the construction areas. Thus, for potential construction fugitive emissions associated with construction of the capture facility, these emissions would likely be contained within the plant property boundary. Potential fugitive emissions from pipeline and well construction would have a potential impact only within several hundred feet of the construction site. These potential emissions would also be short term in duration and would likely have only a minor impact on ambient air concentrations.

Table 3.1-12. Estimated Total Construction Emissions

	CO_2 Capture Facility Total (tons)	Pipelines Total (tons)	Injection Well Sites Total (tons)	Project Total (tons)	Annual Emissions[a] (tpy)
Lower Bound 2 wells located at each of the following sites: Mountaineer Plant and Borrow Area					
CO	32.7	1.2	52.1	86.0	32.2
NO_x	60.5	2.9	130.4	193.8	72.7
PM_{10}	69.4	2.3	11.2	82.9	31.1
$PM_{2.5}$	10.6	0.4	7.2	18.2	6.8
SO_2	0.2	≤0.1	0.2	0.5	0.2
VOCs	5.3	0.3	9.4	15.0	5.6
Upper Bound 2 wells located at each of the following sites: Borrow Area, Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract					
CO	32.7	8.9	104.3	145.9	54.7
NO_x	60. 5	21.9	260.9	343.3	128.7
PM_{10}	69.4	17.8	22.4	109.6	41.1
$PM_{2.5}$	10.6	3.1	14.5	28.2	10.6
SO_2	0.2	0.1	0.4	0.7	0.3
VOCs	5.3	1.9	18.9	26.1	9.8

[a] Based on 32-month project schedule.

CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

Construction of the project would not require a conformity determination under state or federal General Conformity Rule requirements (40 CFR 93 / 45 CSR 35 / 45 CSR 19) if four injection wells (lower bound scenario) or six injection wells were required, as annual emissions would be below the criteria thresholds shown in Table 3.1-5 (e.g., 100 tpy for CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, VOCs [volatile organic compounds]). However, if eight injection wells are required (upper bound, worst-case scenario) the NO_x emissions (a precursor to $PM_{2.5}$) would temporarily (on average over the 32-month construction period) exceed the threshold of 100 tpy (see Table 3.1-5), thus possibly requiring a conformity determination for $PM_{2.5}$.

AEP could further reduce construction-related emissions through the use of industry standard BMPs, including control of vehicle speeds throughout the site, minimizing or stabilizing exposed areas to reduce wind erosion, wetting of exposed areas and roads with water or appropriate surfactants, reducing or eliminating equipment idling time, and using properly maintained equipment.

3.1.3.2 Operational Impacts

CO_2 Capture Facility

The CAP facility would be designed solely for the capture of CO_2 emissions. However, based on the energy and mass balance flow rate for the project, summarized in Table 3.1-13, the CAP would be expected to offer the co-benefit of reducing flue gas emissions, including SO_2, SO_3 and PM, although the amount of potential reduction is not known. For the purpose of evaluating potential impacts on air quality, DOE conservatively assumed that the system would not reduce emissions of SO_2, SO_3, and PM to the emission rates estimated by AEP (see Table 3.1-13).

Table 3.1-13. Mountaineer CCS II Project Flue Gas Nominal Inlet Constituents and Estimate of Constituents Exiting CAP

Flue Gas Constituent	Units	CAP Inlet	CAP Outlet
CO_2	ppmv	105,993	13,000
H_2O	ppmv	150,000	99,000
N_2	ppmv	680,900	813,000
NH_3	ppmv	2.0	10
NO_x	ppmv	100	100
O_2	ppmv	54,900	67,000
PM	lbs/hr	125	50
SO_2	ppmv	80	20
SO_3	ppmv	25	10

CAP = chilled ammonia process; CO_2 = carbon dioxide; H_2O = water; lbs/hr = pounds per hour; N_2 = nitrogen; NH_3 = ammonia; NO_x = nitrogen oxides; O_2 = oxygen; PM = particulate matter; ppmv = parts per million by volume; SO_2 = sulfur dioxide; SO_3 = sulfur trioxide

The CAP is not expected to increase the emission rate of any regulated pollutant in the treated exhaust slipstream. Therefore, merging of the treated slipstream exhaust with the existing Mountaineer Plant exhaust flue gas is not expected to increase the mass emission rates of regulated and permitted air pollutants. However, as described in the following section *Ammonia and Secondary Particulate Formation*, potential ammonia emissions, although not a regulated emission, would be expected to increase. The Mountaineer Plant would continue to operate within the limits of its current Title V operating air permit and AEP would modify the permit to accommodate any regulated new emission sources or activities associated with the project.

New Emission Source of Particulate Matter

The proposed CO_2 capture facility includes two new stationary sources. The first is a process cooling tower to allow for the cooling of incoming flue gas to the CAP. The second is a refrigeration system cooling tower (or bank of multiple evaporative condensers) to serve the process refrigeration system, which chills the process reagent for CO_2 absorption. Both are estimated to be approximately the same size, with similar operational characteristics. The operation of these cooling towers would emit PM in the evaporative exhaust from each tower, dependent upon the amount and character of the dissolved solids in the water source.

DOE calculated potential particulate emissions for a typical cooling tower necessary to provide cooling for the diverted flue gas slipstream from the inlet temperature of 133°F to the outlet temperature of 114°F. DOE assumed PM_{10} and $PM_{2.5}$ emission rates that would effectively be controlled using high-efficiency drift eliminators. Based on this analysis, total emission rates from the two cooling towers for PM_{10} and $PM_{2.5}$ would be 2.8 tpy and 0.1 tpy respectively (see Table 3.1-14 for estimated emissions from one typical cooling tower). These emission rates are well below regulatory thresholds (i.e., 6 lbs/hr, 144 pounds per day, or 10 tpy) that would require a permit modification under West Virginia 45 CSR 13, Subsection 2.17. Impacts from this source on ambient air quality would depend on the final design, location, and actual operating conditions. However, based on the preliminary calculated low emission rates, the source would be considered minor for permitting purposes and similarly expected to have only a minor impact to local air quality. The cooling towers would also have the potential to emit trace amounts of ammonia, which would have a minor potential impact on ambient air quality.

Table 3.1-14. Estimated Emissions Based on Typical Cooling Tower

Cooling Tower Flow
ΔT across the cooling tower = 20°F Cooling Tower Heat Load = 271 MMBtu Circulating water flow = 271 MMBtu x (1,000,000 Btu/MMBtu) / (20 lbs/hr/Btu) x (1 gal/8.34 lbs) x (1 hr/60 minutes) Circulating water flow = 27,060 gal/minute
Drift, TDS, and PM Speciation
Cooling Tower Drift = 0.0025 percent (Marley Class NC tower with high efficiency drift eliminators) Cooling Tower TDS = 18,500 ppm (EPA, 1995, Table 13.4.1, geometric mean, counter flow tower) No. of Cooling Tower Cells = 8 Cooling Tower Flow/Cell = 3,500 gal/minute
PM_{10} Emissions
PM_{10} / Total PM = 5 percent (Reisman et al., 2002, Figure 1) PM_{10} = 0.05 x 0.000025 x (18,500/1,000,000) x 8 x 3,500 gal/minute x 8.34 lbs/gal x 60 minutes/hr PM_{10} = 0.32 lbs/hr PM_{10} = 0.32 lbs/hr x 8,760 hr/yr x 1 ton/2,000 lbs **PM_{10} = 1.42 tpy/tower**
$PM_{2.5}$ Emissions
$PM_{2.5}$ / Total PM = 0.2 percent (Reisman et al., 2002, Table 2) $PM_{2.5}$ = 0.002 x 0.000025 x (18,500/1,000,000) x 8 x 3,500 gal/minute x 8.34 lbs/gal x 60 minutes/hr $PM_{2.5}$ = 0.013 lbs/hr $PM_{2.5}$ = 0.013 lbs/hr x 8,760 hr/yr x 1 ton/2,000 lbs **$PM_{2.5}$ = 0.057 tpy/tower**

Note: This table represents characteristics of one cooling tower. The project would have two cooling towers of similar characteristics.

ΔT = change in temperature; °F = degrees Fahrenheit; gal = gallon; hr = hour; lbs = pounds; MMBtu = million British thermal units; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; ppm = parts per million; TDS = total dissolved solids; tpy = tons per year

The project would be located in a nonattainment area for $PM_{2.5}$, which would require offset of $PM_{2.5}$ emissions if the project would be subject to the nonattainment NSR permitting program. Under such circumstances, $PM_{2.5}$ offsets would likely be greater than $PM_{2.5}$ emissions from the new cooling towers, and result in an overall reduction in $PM_{2.5}$ emissions in the local area. However, based on the low emission levels, it is unlikely the project would be subject to these NSR requirements.

Ammonia and Secondary Particulate Formation

Ammonia would be the only flue gas constituent that would be expected to increase in the CAP's treated exhaust slipstream and in the Mountaineer Plant's flue gas stack emissions. This increase would result from ammonia that may potentially remain in the exhaust gas exiting the CAP. However, there are no ambient air quality standards for ammonia, and the Mountaineer Plant's Title V operating permit does not regulate ammonia emissions from the existing plant. Although ammonia is not a regulated pollutant, DOE considered the potential impacts from increased ammonia concentrations in the flue gas due to the potential for secondary particulate formation. Ammonia in the presence of SO_x and NO_x has the potential to influence the formation of secondary particulates in the form of ammonium salts, for example, ammonium sulfate ($[NH_4]_2SO_4$) and ammonium nitrate (NH_4NO_3). Secondary particulate formation may impact visibility and in theory be of concern especially in protected Class I areas. However, as described below, net emissions of particulates are expected to be reduced when considering the CAP's overall increased removal rates for filterable PM_{10}.

Based on the energy and mass balance developed for the CAP, ammonia concentrations would have the potential to increase from a nominal 2 parts per million by volume (ppmv) in the CAP influent gas up to 10 ppmv in the CAP effluent gas. As a result, ammonia concentrations in the existing Mountaineer Plant flue gas would potentially increase from 2 ppmv to approximately 3.3 ppmv, or by approximately 50 tpy. DOE conservatively assessed the potential for the formation of secondary particulates assuming that all of the additional ammonia in the effluent would chemically react with the available SO_2 and NO_x to form ammonium sulfate and ammonium nitrate particles. In addition, for the purpose of analysis, the ammonia from the CAP is assumed to result in additional secondary particulate formation. These secondary particulates could also be produced without the increased ammonia from the project since there are substantial ammonia emissions from other sources in the region which contribute to a background ammonia concentration of approximately 0.7 parts per billion (Sweet, et al., 2005). Ammonia emissions reported from other sources in West Virginia, and in the nearby states of Ohio and Kentucky, for the annual period of 2008 were approximately 3,900 tons. The additional ammonia emissions from the CAP of approximately 50 tpy represent only a minor fraction of these regional emissions (approximately 1.3 percent).

DOE evaluated two cases for secondary particulate formation compared to the existing Mountaineer Plant operating at full load without the CAP. For Case 1, DOE considered all the ammonia reacted to form ammonium sulfate, resulting in 73.7 lbs/hr of condensable PM_{10}. For Case 2, DOE considered all the ammonia reacted to form ammonium nitrate, resulting in 89.3 lbs/hr of condensable PM_{10}. The reactions for Case 1 and Case 2 are competing reactions, and any given ammonia molecule can react to form either sulfate or nitrate, but not both. Results of this analysis are presented in Table 3.1-15, which indicates a theoretical secondary PM_{10} formation increase between 43.1 and 52.2 lbs/hr. However, operation of the CAP would at the same time decrease the emissions of filterable PM_{10} by 75 lbs/hr. Consequently, the net filterable PM_{10} plus condensable PM_{10} emissions are expected to result in an overall decrease of PM_{10} between 22.8 and 31.9 lbs/hr. The resulting decrease in PM_{10} would likely have a beneficial impact on air quality in the ROI.

Affect of Merged Exhaust Streams

In the original CAP design, Alstom and AEP considered two potential options for the exhaust of the diverted slipstream to the atmosphere after CAP treatment. The options included potential discharge via the existing boiler exhaust stack or via a new stack to be constructed as a part of the Mountaineer CCS II Project. The only option being considered in the current design is to redirect the slipstream from the CAP back into the power plant effluent stream and exhaust the combined stream through the existing stack. Table 3.1-16 presents the existing power plant stack effluent parameters (current baseline conditions at full load) and the anticipated CAP exhaust gas conditions expected to result from the combination of the effluent streams.

Table 3.1-15. Summary of Estimated PM_{10} Emissions for the Existing Mountaineer Plant without and with the CAP System

Parameter	Mountaineer Plant without CAP System[a] (nominal values)	Mountaineer Plant with CAP System[a] (estimated values)	Increase / (Decrease)
Total flow (lbs/hr)	15,796,208	15,336,982	
Temperature (°F)	133	130	
Volume flow (acfm)	4,047,496	3,910,689	
PM_{10} (lbs/hr)			
Filterable PM_{10}	700	625	(75)
Condensable PM_{10}[b] (from estimated NH_3 in the flue gas only) (lbs/hr)			
Case 1 – 100-percent sulfates	73.7[c]	116.8[d]	43.1
Case 2 – 100-percent nitrates	89.3[c]	141.5[d]	52.2

[a] Assumes Mountaineer Plant operating at full-load conditions.
[b] Condensable secondary PM_{10} formed from NH_3 may be emitted as either sulfate or nitrate. Cases 1 and 2 correspond to the extreme cases of 100 percent of sulfate and 100 percent nitrate formation, respectively.
[c] Estimated contribution from nominal 2 ppm NH_3 in the flue gas.
[d] Estimated contribution from nominal 2 ppm NH_3 in the flue gas plus 10 ppm from the CAP outlet gas.
acfm = actual cubic feet per minute; CAP = chilled ammonia process; °F = degrees Fahrenheit; lbs/hr = pounds per hour; NH_3 = ammonia; PM_{10} = particulate matter of diameter 10 microns or less

Table 3.1-16. Existing Mountaineer Stack and Estimated CCS II Project Exhaust Flue Gas Parameters

Exhaust Flue Gas Parameter	Existing Mountaineer Stack Exhaust (nominal values)	CAP Exhaust (estimated values)	Combined Stack Exhaust (estimated values)
Temperature (°F)	133	114	130
Pressure (psia)	14.5	14.7	14.5
Flow rate (acfm)	4,047,496	617,883	3,880,586
Mass flow rate (lbs/hr)	15,796,208	2,439,891 [2,884,172][a]	15,218,922
Density (lbs/ft^3)	0.065	0.071	0.0654
H_2O concentration (percent volume)	15	9.9	14.2
H_2O mass flow rate (lbs/hr)	1,497,470	157,973	1,364,612
Average flue gas molecular weight	28.53	28.23	28.53

[a] Operating condition where CO_2 compression and/or storage is not available and captured CO_2 is returned to the CAP flue gas outlet (not typical).
acfm = actual cubic feet per minute; CAP = chilled ammonia process; °F = degrees Fahrenheit; H_2O = water; lbs/ft^3 = pounds per cubic foot; lbs/hr = pound per hour; psia = pounds-force per square inch absolute

Treatment of the plant slipstream through the CAP would be designed to remove approximately 90 percent of the CO_2 and some of the water vapor and other constituents, which would result in a modified exhaust slipstream exiting the CAP and, ultimately, the combined stack exhaust. A modification of effluent gas conditions such as temperature, exhaust velocity, or volume from a stack with specific physical parameters of height and exit diameter can influence the subsequent plume behavior and potentially affect ground-level ambient air concentrations. Table 3.1-17 provides the estimated stack parameters based on three different plant load conditions: full, mid, and low loads.

Table 3.1-17. Mountaineer Plant: Estimated Stack Parameters without and with the Project

Stack Parameter	Units	Without the Project (nominal values)	With the Project (estimated values)	Change
Full Load[a] (90 percent or greater)[b]:				
Temperature	°F	133.0	130.0	3.0°F decrease
Exhaust flow	acfm	4,077,753	3,910,689	4.1 percent decrease
Exit velocity	ft/sec	47.9	46.0	4.1 percent decrease
Mid-Load[a] (70 to 90 percent)[b]				
Temperature	°F	133.0	129.3	3.7°F decrease
Exhaust flow	acfm	3,299,982	3,133,292	5.1 percent decrease
Exit velocity	ft/sec	38.8	36.8	5.1 percent decrease
Low Load[a] (50 to 70 percent)[b]				
Temperature	°F	133.0	126.9	6.1°F decrease
Exhaust flow	acfm	2,073,696	1,906,700	8.1 percent decrease
Exit velocity	ft/sec	24.4	22.4	8.1 percent decrease

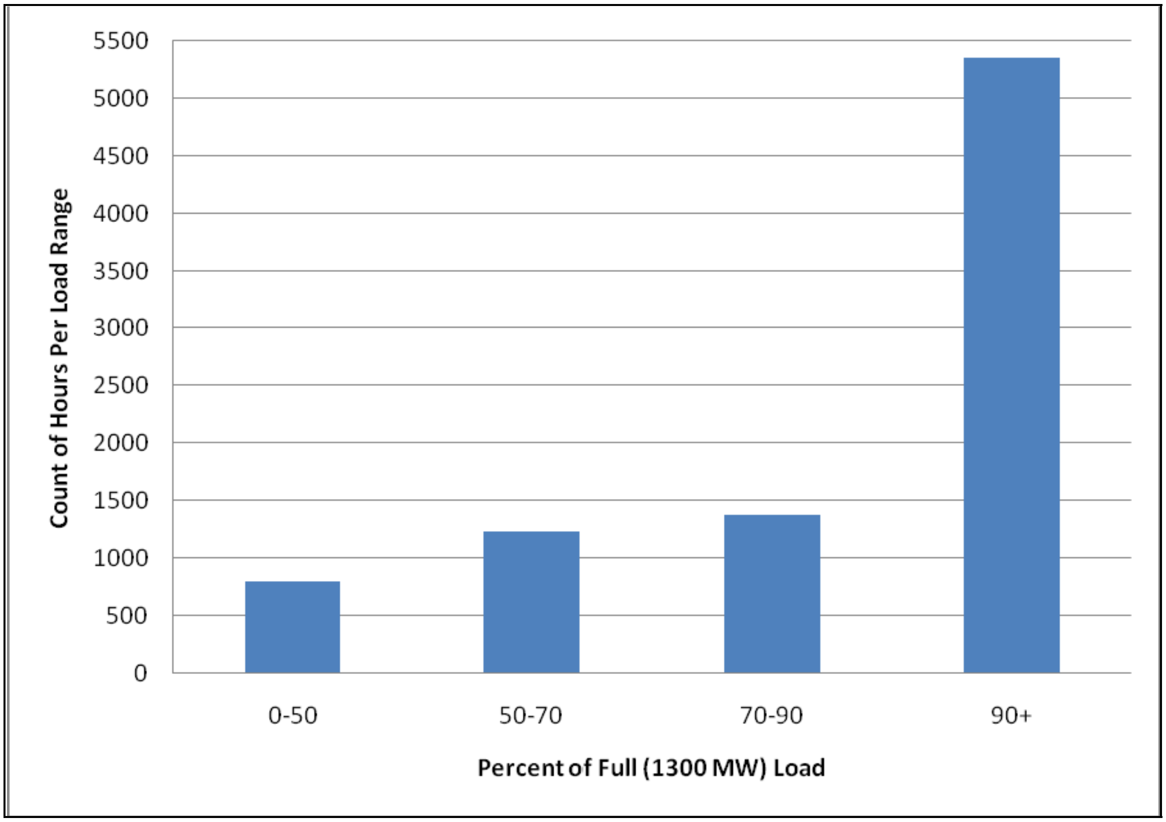
[a] The full, mid- and low load stack parameter data correspond to nominal loads of 100, 75 and 50 percent, respectively.

[b] In 2009, 67, 17 and 16 percent of the Mountaineer plant's steady-state operating hours occurred within the above-specified full, mid- and low load ranges, respectively. The Mountaineer plant did not operate, or operated at a load below 50 percent, during 9 percent of the hours in 2009.

acfm = actual cubic feet per minute; °F = degrees Fahrenheit; ft/sec = feet per second

Table 3.1-17 summarizes the variable characteristics of the exhaust gas before and after the CAP slipstream is merged into the existing stack. The table indicates that operation of the CAP would have very little effect on the variable exhaust gas characteristics of the existing stack. For example, at full-load operating conditions, the net result would be a 4.1 percent reduction in the exhaust gas flow rate and a 3.0°F reduction in the exhaust gas temperature of the existing stack. These differences in temperature and flow rates are relatively small and within the short-term range of expected load and stack measurement variability.

To assess the annual frequency of this effect on the longer term or annual operation of the existing Mountaineer Plant, DOE evaluated the frequency of occurrence of the plant load conditions for the 2009 operating period. Figure 3.1-3 provides a histogram of calendar year 2009 operating load data for the Mountaineer Plant. The data were obtained from the EPA Clean Air Markets Database (EPA, 2010e). The figure shows that, in 2009, the plant operated predominantly at or near full load, with 66 percent of its actual operating hours at loads of 90 percent or more. This information indicates that the full-load operating conditions provided in Table 3.1-17 represent the predominant operating conditions for the existing plant.



Source: EPA, 2010e

Figure 3.1-3. AEP Mountaineer Plant Operating Load Frequency Distribution

Changes in exhaust characteristics, such as flow rate and temperature, could potentially affect plume height and dispersion patterns, and thus change where and how the plume travels, the receptors, and air quality impact. To evaluate the impact, DOE used the EPA model SCREEN3 (EPA, 2010f) to calculate the potential change in plume height for the merged and unmerged effluent scenarios. Exhaust characteristics for each of the merged and unmerged scenarios were input into the SCREEN3 model, which then calculated plume heights at increasing downwind distances from the stack.

Figure 3.1-4 illustrates the plume height for various worst-case meteorological conditions at downwind distances from the stack. As shown in this figure, the plume heights of the slightly modified stack effluent are calculated to be very similar to the baseline scenarios without the CAP influence. This is evident at all downwind distances and all meteorological conditions considered. Therefore, it is expected that any potential impact from a change to plume behavior from the exhaust merge would be minimal or insignificant. In addition, merging the existing plant emissions with the CAP exhaust (with reduced SO_2, SO_3, and PM emissions) would likely result in a net reduction in ground-level ambient concentration of these pollutants. Thus, the merge would likely have a beneficial impact on air quality.

Indirect Emissions

Potential emissions of VOCs, CO, NO_x, SO_2, and particulates would occur from routine operations as a result of vehicle use related to employee vehicle trips, material and waste shipments, and maintenance and inspection activities. As shown in Table 2-3, there are various transport options for the materials and wastes to and from the CO_2 capture facility. These include scenarios of using trucks and/or using rail shipments. For this analysis, DOE assumed the most conservative transport scenarios in regard to air emissions, and an upper-bound project scenario requiring four injection well sites. Thus, DOE assumed that all transport would be by truck and that aqueous ammonia would be chosen as the reagent (i.e., this option requires the most truck trips). The estimates assume two 40-mile round trips per day to inspect the injection wells, and truck traffic to each of the four injection well sites for periodic maintenance activities. Using these assumptions, Table 3.1-18 presents the operational vehicle travel estimates for the air emission calculations, including the estimated amount of heavy-duty diesel vehicles and light-duty gasoline vehicles on an annual basis.

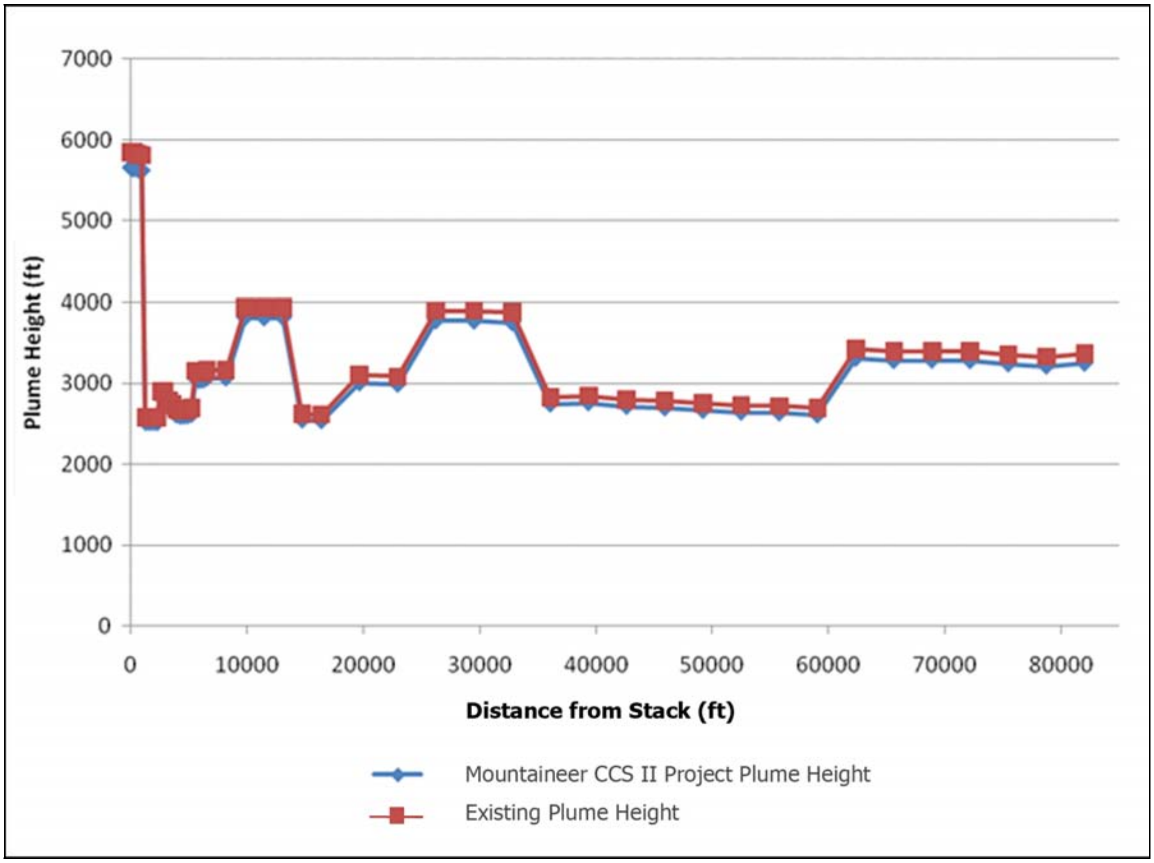


Figure 3.1-4. Exhaust Stack Plume Height vs. Distance under Full Load and Full Meteorological Conditions, with and without the Project

Source: Modeled using SCREEN3 (EPA, 2010f)

Note: Mountaineer CCS II Project Plume Height presents the scenario of the CAP exhaust merged with the existing stack exhaust

The estimated emissions associated with operational-related vehicle trips and activities would be relatively minor compared to the overall emissions in the ROI (see Table 3.1-19). Thus, emissions from these sources would have a negligible impact on air quality. AEP could further reduce operational indirect emissions through the use of industry standard BMPs, including control of vehicle speeds throughout the site, reducing or eliminating equipment idling time, using properly maintained equipment, and minimizing, as practicable, the use of diesel or gasoline generators.

Operation of the project would require approximately 50 to 80 MW of electrical power from the existing Mountaineer Plant. This is within the available power generation capacity of the Mountaineer Plant, which generates more than 1,300 MW of power. The increase in electrical demand, approximately 3 percent of power generated onsite, would have a minor impact on the available power in the area and would have a negligible impact on air quality.

Table 3.1-18. Estimated Operational Vehicle Travel

Purpose of Trip	Vehicle	Number of Trips per Year	Round Trip (miles)	VMT/Year
CO_2 Capture Facility				
Raw material deliveries:				
Aqueous ammonia[a]	HDDV	430	230	98,900
Sulfuric acid	HDDV	120	60	7,200
By-product removal:				
Ammonium sulfate	HDDV	730	420	306,600
Employee commute:				
38 New employees	LDGV	16,425[b]	40	657,000
Injection Well Sites[c]				
Inspection: pickup trucks	LDGV	730	40	29,200

[a] AEP may choose either anhydrous ammonia or aqueous ammonia as the reagent. The aqueous ammonia scenario is analyzed for air emissions as it would require more truck deliveries, and would therefore produce a more conservative analysis.
[b] Assumed approximately 45 cars per day accounting for 20 percent carpool rate and additional visitors; Assumed 365 days of operation per year.
[c] The transport of wastewater during maintenance activities at the injection well sites would also generate truck trips; however, this is expected to occur infrequently and would generate a low volume of truck trips.
HDDV = heavy-duty diesel vehicles; LDGV = light-duty gasoline vehicle; VMT/Year = vehicle miles traveled per year

Table 3.1-19. Estimated Indirect Emissions from Operational Vehicle Travel

Pollutant[a]	CO_2 Capture Facility (tpy)	Injection Well Sites (tpy)	Total (tpy)
CO	10.2	0.5	10.7
NO_x	1.8	0.2	2.0
PM	0.1	<0.1	0.1
SO_2	<0.1	<0.1	<0.1
VOCs	0.4	<0.1	0.5

[a] Emission factors and class designations obtained from MOBILE6 (EPA, 2003).
CO = carbon monoxide; NO_x = nitrogen oxides; PM = particulate matter; SO_2 = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds

Total Direct Emissions

Table 3.1-20 presents the total direct emissions for the operation of the project.

Table 3.1-20. Summary of Potential Direct Impacts of Operation

Constituent	Units	Emission Source[a]		
		Plant Stack	Cooling Tower	Total
CAP Inlet (nominal values)				
NH_3	tpy	15.8		15.8
SO_2	tpy	2,371.6		2,371.6
SO_3	tpy	926.2		926.2
PM_{10}				
Filterable	tpy	547.5		547.5
Condensable	tpy			
Total	tpy	547.5		547.5
CAP Outlet (estimated values)				
NH_3	tpy	64.4		64.4
SO_2	tpy	485.0		485.0
SO_3	tpy	303.0		303.0
PM_{10}				
Filterable	tpy	219.0	2.8	221.8
Condensable[b]	tpy	228.7		228.7
Total[b]	tpy	447.7	2.8	450.5
Increase (Decrease) with CAP				
NH_3	tpy	48.7		48.7
SO_2	tpy	(1,886.6)		(1,886.6)
SO_3	tpy	(623.2)		(623.2)
PM_{10}				
Filterable	tpy	(328.5)	2.8	(325.7)
Condensable[b]	tpy	228.7		228.7
Total[b]	tpy	(99.8)	2.8	(97)

[a] Based on 8,760 hours per year of operation

[b] Condensable fraction considers only PM_{10} derived from potential NH_3 in flue gas.

Note: Gray-shaded cells indicate non-applicability.

CAP = chilled ammonia process; NH_3 = ammonia; PM_{10} = particulate matter of diameter 10 microns or less; SO_2 = sulfur dioxide; SO_3 = sulfide trioxide; tpy = tons per year

The total direct and indirect air emissions from the project are expected to have minimal impact on regulated air emissions of PM and a beneficial reduction of or no impact on other air pollutants, including HAPs and air toxics. Emissions of ammonia are estimated to increase by 48.7 tpy and condensable particulates (related only to potential ammonia-derived PM_{10}) would increase as much as 228.7 tpy. However, total PM_{10} emissions would decrease due to a reduction of filterable particulates removed in the CAP.

Based on the expected overall reduction of emissions from the existing Mountaineer Plant and the anticipated annual emission rates of the project, the permitting thresholds for major modification or NSR applicability would not be exceeded. Thus, it is expected that the PSD NSR permitting requirements would not be triggered. However, the project would likely be subject to state permitting requirements to construct and may be subject to nonattainment requirements to offset potential emissions of $PM_{2.5}$. If applicable, AEP would comply with these requirements. DOE does not expect operation of the project to interfere with WVDEP's air quality attainment or maintenance plans.

Amine-Based Capture System Feasibility Study

An amine-based CO_2 capture system would emit amines into the atmosphere. The composition of those emissions would depend, in large part, on the specific amines present in the solvent solution, degradation products, and any chemical additives used to control corrosion or adjust pH. Amine emissions might be contained within water droplets as well as gases. Any amine emissions would likely naturally degrade in the atmosphere. Annual emissions from an amine-based system could likely be in the range of 44 to 176 tons (40 to 160 metric tons) for a system capturing approximately one million metric tons of CO_2 annually (Bellona, 2009). The feasibility study would evaluate this issue in more detail. Amines and amine degradation products in the presence of sulfur and nitrogen oxides (SO_x and NO_x) have the potential to influence the formation of secondary particulates (Malloy, 2009).

3.1.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to air quality.

3.2 GREENHOUSE GASES

3.2.1 Introduction

This section identifies and describes emissions of GHGs that could potentially occur as a result of the construction and operation of the Mountaineer CCS II Project. This section also estimates the contribution of these GHGs emissions on a regional, national, and global scale. Potential benefits of the project resulting from reductions in GHG emissions are also addressed. It should be noted that this section focuses on estimation of GHG emissions; whereas the discussion of the impacts of GHG emissions is provided in Section 4.2, Potential Cumulative Impacts, as explained in Section 3.2.1.2. Information on the climate in the region of the Mountaineer CCS II Project is presented in Section 3.1, Air Quality and Climate.

3.2.1.1 Region of Influence

The ROI for GHG emissions is broadly discussed in regional (the State of West Virginia), national (the U.S.), and global terms. Potential impacts of GHGs on climate change are generally viewed from a global cumulative perspective.

3.2.1.2 Method of Analysis

The emission of anthropogenic GHGs and their potential contribution to global warming are an inherently cumulative phenomena. That is, emissions of GHGs from the project by itself would not have a measurable direct impact on the regional or global environment. Accordingly, the contributions to atmospheric GHGs from the Mountaineer CCS II Project are discussed in this section, and analyzed as cumulative impacts in Section 4.2, Potential Cumulative Impacts.

3.2.1.3 Factors Considered for Assessing GHG Emissions

DOE assessed the potential for changes in emissions of GHGs based on whether the project would directly or indirectly

- cause significant increases in emissions of GHGs in the atmosphere; or
- threaten to violate federal, state, or local laws or requirements regarding GHG emissions.

Current scientific methods do not allow one to correlate emissions from a specific source with a particular change in either local or global climates; therefore, changes to the regional climate are discussed as a cumulative impact in Section 4.2, Potential Cumulative Impacts. Greenhouse gas data were obtained from a variety of sources including the EPA, U.S. Energy Information Administration, the Intergovernmental Panel on Climate Change (IPCC), the World Resources Institute, and the United States Global Change Research Program (USGCRP), formerly the U.S. Climate Change Science Program.

3.2.2 Affected Environment

3.2.2.1 Emissions of Greenhouse Gases

Greenhouse gases are gases in the earth's atmosphere that help regulate the temperature of the planet by allowing infrared radiation (sunlight) to reach the Earth's surface and then absorbing and emitting some of the radiation. This process, known as the greenhouse effect, essentially traps some of the earth's heat in the atmosphere. Without atmospheric GHGs, the earth's temperature would be approximately 60°F colder than at present and would not support life as we know it (EPA, 2009a). Since the Industrial Revolution (onset circa 1750), anthropogenic (related to human activities) emissions of GHGs have increased, resulting in current concerns about the potential for global climate change.

Greenhouse gases include water vapor, CO_2, methane (CH_4), nitrous oxide (N_2O), O_3, and several classes of halogenated substances that contain fluorine, chlorine, or bromine (including chlorofluorocarbons). After water vapor, CO_2 is the most abundant GHG but, unlike water vapor, the CO_2 remains in the atmosphere for long periods of time and tends to mix quickly and evenly throughout the lower levels of the global atmosphere. There are also several gases that do not have a direct global warming effect, but indirectly affect terrestrial or solar radiation absorption by influencing the formation or destruction of GHGs, including O_3. These gases include CO, NO_X, and non-methane VOCs. Extremely small particles, such as SO_2 or elemental carbon emissions, can also affect the absorptive characteristics of the atmosphere and therefore influence the greenhouse effect.

CO_2-equivalent is a measure used to compare GHGs based on their global warming potential, using the functionally equivalent amount or concentration of CO_2 as the reference. The CO_2-equivalent for a gas is derived by multiplying the amount of the gas by its global warming potential; this potential is a function of the gas's ability to absorb infrared radiation and its persistence in the atmosphere after it is released.

Although GHGs (CO_2, CH_4, and N_2O) occur naturally in the atmosphere, numerous human activities from all sectors of the economy also release these gases into the atmosphere. Since GHG impacts are often assessed on a global (international) scale, GHGs are typically measured in metric units, specifically, metric tons, otherwise known as "*tonnes.*" GHGs are often reported as CO_2-equivalents (CO_2-eq), which is a measurement that puts all GHGs in relative terms to CO_2 (the predominant GHG), based on their global warming potential. Global warming potential is a measure of how much a given mass of GHG is estimated to contribute to global warming in comparison to an equivalent mass of CO_2. The global warming potential is used as a multiple to calculate CO_2-eq (IPCC, 2007; UNFCCC, 2010).

Current Emissions

In the pre-industrial era (before 1750 AD), the concentration of CO_2 in the atmosphere appears to have been approximately 280 parts per million (ppm) (IPCC, 2007). Data indicates that from the 1700's to current day, global atmospheric concentrations of CO_2 have risen approximately 36 percent (EPA, 2009a). In 1958, C.D. Keeling and others began measuring the concentration of atmospheric CO_2 at Mauna Loa in Hawaii (NOAA, 2010). Measurements by Keeling's team and others document that the amount of CO_2 in the atmosphere has been steadily increasing from approximately 316 ppm in 1959 to 384.8 ppm in 2008 (NOAA, 2010; CDIAC, 2010a). Figure 3.2-1 depicts the changes in global CO_2 concentrations and emissions over the past 250 years (CDIAC, 2010b). The average annual CO_2 concentration growth rate during the last decade (1998-2008 average: 1.9 ppm per year) has been significantly higher than the average CO_2 growth rate during the last half century (1959-2009 average: 1.4 ppm per year) (NOAA, 2010). Industrial and agricultural activities release GHGs other than CO_2—notably CH_4, N_2O, O_3, and chlorofluorocarbons—to the atmosphere, where they can remain for long periods of time.

Emissions of CO_2 from fossil fuel combustion within the State of West Virginia totaled 116.4 million metric tons in 2007, with 85.5 million metric tons resulting from electric power generation (EPA, 2010g). In the U.S., overall anthropogenic GHG emissions in 2008 totaled approximately 7,050 million metric tons as measured in CO_2-eq, of which 83 percent was composed of CO_2 (EIA, 2009a). Table 3.2-1 shows that as of 2008, the CO_2 emissions from U.S. electricity generation increased by 30 percent since 1990, while in comparison, total CO_2 emissions (from all reported sources) grew by 16 percent. In 2008, electric power generation contributed 41 percent of all CO_2 emissions in the U.S., of which 82 percent was attributable to the use of coal.

Figure 3.2-2 shows long-term projections in CO_2 emissions by sector and source for the year 2030 compared to current rates, after considering higher but uncertain world oil prices, growing concern about GHG emissions, increasing use of renewable fuels, increasing shift to use of more efficient vehicles, improved end-use appliance efficiency, and general trends in production and usage of various fuel types (EIA, 2009b). Over the next 2 decades, the largest share of U.S. CO_2 emissions will continue to come from electricity generation, followed closely by transportation. However, while electricity generation is projected to increase by 0.9 percent per year, CO_2 emissions from electricity generation would increase by only 0.5 percent per year. This projected slowed rate of increase in emissions is in part due to an expected increase in renewable energy sources from 8 percent in 2007 to 14 percent in 2030, as well as efficiency improvements in technologies that emit less CO_2 and the commercial availability of CO_2 mitigation techniques. More rapid improvements in technologies, mitigating requirements, and more rapid adoption of voluntary and mandatory CO_2 emissions reduction programs could result in even lower CO_2 emissions levels than those projected (EIA, 2009b).

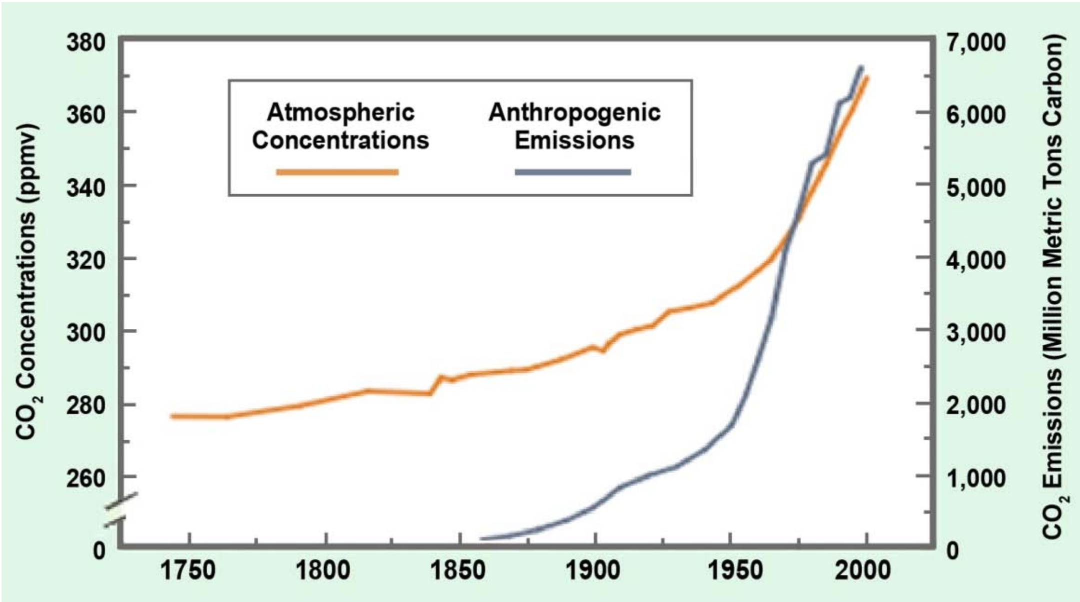


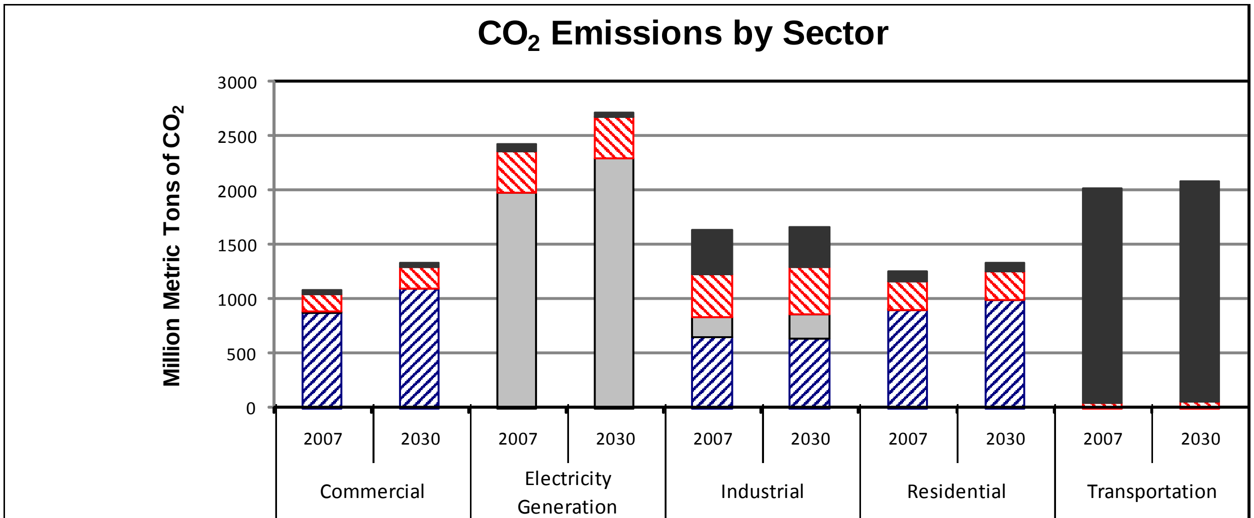
Figure 3.2-1. Historical Trends in Global Atmospheric CO_2 Concentrations and Emissions

Source: CDIAC, 2010b

Table 3.2-1. United States CO_2 Emissions from Electric Power Sector Energy Consumption, 1990-2008 (million metric tons)

Fuel	1990	1995	2000	2005	2006	2007	2008
Petroleum	101.8	60.7	91.5	102.3	55.6	55.3	39.7
Coal	1,531.2	1,648.7	1,910.8	1,963.9	1,937.8	1,970.6	1,945.9
Natural Gas	175.5	228.2	280.9	319.1	338.2	371.7	362.0
Municipal Solid Waste	5.7	9.9	10.0	11.1	11.4	11.2	11.2
Geothermal	0.4	0.3	0.4	0.4	0.4	0.4	0.4
Total CO_2 from Electric Power Sector	1,814.6	1,947.9	2,293.5	2,396.8	2,343.5	2,409.1	2,359.1
Total CO_2 Emissions from all Energy-Related Sectors	5,020.1	5,302.3	5,850.4	5,974.3	5,893.7	5,986.4	5,814.4

Source: EIA, 2009a
CO_2 = carbon dioxide



	Commercial 2007	Commercial 2030	Electricity Generation 2007	Electricity Generation 2030	Industrial 2007	Industrial 2030	Residential 2007	Residential 2030	Transportation 2007	Transportation 2030
Petroleum Sector	45	42	66	41	406	375	88	75	1974	2032
Natural Gas Sector	163	188	376	378	405	440	257	269	35	43
Coal Sector	7	6	1980	2299	175	215	1	1	0	0
Electricity Sector	872	1096	0	0	653	638	904	987	4	9

Figure 3.2-2. United States CO_2 Emissions by Sector

Source: EIA, 2009b (developed from 2007 and projected 2030 data presented in Report No. DOE/EIA-0383 [2009])

Greenhouse Gas Initiatives and Programs

Concerns regarding the relationship between GHG emissions from anthropogenic sources and changes to climate have led to a variety of federal, regional, and state initiatives and programs aimed at reducing or controlling GHG emissions from human activities. Table 3.2-2 summarizes important federal legislation, policy, and legal decisions regarding GHGs. In addition to federal actions, numerous states and regional organizations have also taken action to address GHG concerns. In recent years, the State of West Virginia, as well as the MRCSP, which includes West Virginia, have initiated various actions to address GHG concerns. Table 3.2-3 summarizes these actions. Currently, there are no West Virginia regulations pertaining to limits in emissions of GHGs.

Table 3.2-2. Federal Initiatives to Address GHG Concerns

Legislation	Description
U.S. Supreme Court Decision	U.S. Supreme Court decision (Massachusetts v. EPA, April 2007) that six key GHGs meet the CAA definition of air pollutants. The decision concluded that EPA has authority to regulate GHGs if it is determined they pose an endangerment to public health and welfare (EIA, 2009a).
Consolidated Appropriations Act of 2008/ Public Law 110-161 / Mandatory GHG Reporting Program. 40 CFR 98	Consolidated Appropriations Act of 2008 directed the EPA to develop a mandatory reporting rule for GHGs. EPA issued 40 CFR 98 requiring annual reporting of GHGs from large sources and suppliers in U.S. that emit 25,000 metric tons or more of GHG emissions. Part 98 became effective December 2009. Final Rule signed September 2009. Requires emitters of GHGs to report emissions to EPA, with first annual emissions reports due in 2011 (74 FR 56260).
American Recovery and Reinvestment Act of 2009 ("The Stimulus Bill")	Under the Act, DOE received $36.7 billion to fund renewable energy, carbon capture and storage, energy efficiency, and smart grid projects, among others (February 2009). The projects are expected to provide reductions in both energy use and GHG emissions (EIA, 2009a).
EO 13514, Federal Leadership in Environmental, Energy and Economic	EO (issued October 2009) to make reduction of GHG emissions a priority for federal agencies (EO 13514).

Table 3.2-2. Federal Initiatives to Address GHG Concerns

Legislation	Description
Performance	
EO 13432	EO issued (May 2007) to control GHG emissions from motor vehicles, nonroad vehicles, and nonroad engines (White House, 2007).
EPA and DOT Proposed GHG Emissions and CAFE Standards	EPA and DOT National Highway Traffic and Safety Administration have promulgated new standards for model year 2012 to 2016 light- medium-duty vehicles to reduce GHG emissions under the CAA, and new CAFE standards to improve fuel economy under the Energy Policy and Conservation Act (September 2009) (EPA, 2009b).
Prevention of Significant Deterioration/Title V GHG Tailoring Rule	EPA rule (May 2010) limits applicability of GHG emissions standards under the CAA to new and modified stationary sources that emit more than 75,000 tons CO_2-eq annually and that are subject to PSD and Title V for another regulated pollutant (beginning January 2, 2011). If GHGs exceed the threshold, the GHG emissions would be subject to BACT and other relevant requirements that apply to PSD permits (EPA, 2010h; EPA, 2010i).
EPA GHG Endangerment Finding	GHG Endangerment Finding determination and issuance by EPA (December 2009). EPA finds that six key GHGs pose threat to public health and welfare for current and future generations, and emission of these GHGs from new motor vehicle emissions contribute to GHG pollution (EPA, 2009c).
DOE Clean Coal Demonstration Programs	Three DOE funding assistance programs to demonstrate Clean Coal projects including: 1. Clean Coal Power Initiative, established 2001. To invest in projects that demonstrate advanced coal-based technologies that capture and sequester, or put to beneficial use, CO_2 emissions from commercial scale coal-fired power plants. Final CCPI Round 3 awarded 2009, and included offer of funding assistance to AEP's Mountaineer CCS II Project. 2. Power Plant Improvement Initiative, established in 2000. Completed its fourth and final project. 3. Clean Coal Technology Demonstration Program, established in 1986. Completed its 33rd and final project (NETL, 2010b).
DOE Carbon Sequestration Grants	In October 2006, DOE announced $24 million in grants for carbon sequestration research aimed at developing novel and cost-effective technologies to capture CO_2 produced in coal-fired power plants so it can be safely and permanently sequestered. Grant recipients would contribute nearly $8 million in cost-sharing for the program (NETL, 2006).
DOE Loan Guarantee Program	In September 2009, DOE announced an $8 billion solicitation for clean coal technologies, "Federal Loan Guarantees for Coal-Based Power Generation and Industrial Gasification Facilities that Incorporate Carbon Capture and Sequestration or Other Beneficial Uses of Carbon and for Advanced Coal Gasification Facilities." Of the total amount, $6 billion is allocated to coal-based power generation and industrial gasification facilities that incorporate CCS or other beneficial uses of carbon, with the remaining $2 billion devoted to advanced coal gasification projects (CURC, 2008).

AEP = American Electric Power Service Corporation; BACT = Best Available Control Technology; CAA = Clean Air Act; CAFE = Corporate Average Fuel Economy; CCPI = Clean Coal Power Initiative; CCS = carbon capture and storage; CO_2-eq = carbon dioxide equivalent; CFR = Code of Federal Regulations; DOE = U.S. Department of Energy; DOT = U.S. Department of Transportation; EO = Executive Order; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; PSD = Prevention of Significant Deterioration

Table 3.2-3. Regional and State Actions to Address GHG Concerns

Action/Initiative	Description
Midwest Regional Carbon Sequestration Partnership	The MRCSP, which includes West Virginia along with eight other contiguous states, is one of seven regional partnerships established by the DOE throughout the United States and Canada to assess the technical potential, economic viability, and public acceptability of carbon sequestration as one option for mitigating climate change (NETL, 2010c).
West Virginia House Bill 103	In June 2009, the West Virginia legislation enacted House Bill 103, creating an "alternative and renewable energy portfolio standard." The law defines "advanced coal technology" (including CCS) as an "alternative energy resource" that can be used along with renewable energy resources (e.g., solar energy, wind power, etc) to meet state and federal environmental standards. Eligible resources must meet 25 percent of electricity sales by 2025 (West Virginia Legislature, 2009; EIA, 2010).

CCS = carbon capture and storage; DOE = U.S. Department of Energy; GHG = greenhouse gas; MRCSP = Midwest Regional Carbon Sequestration Partnership

3.2.3 Direct and Indirect Emissions from the Proposed Action

3.2.3.1 Construction Emissions

Construction of the project would generate GHG emissions from the use of construction trucks, equipment, and construction worker vehicles. AEP estimated the duration of construction activity and the amount and type of construction equipment to be used in building the Mountaineer CCS II Project. From these quantities and durations, DOE estimated construction equipment emissions based on emission factors and load rates from EPA's NONROAD model (EPA, 2005; EPA, 2008); and vehicle emissions based on class designations and emission rates from MOBILE6 (EPA, 2003). Emission factors for N_2O and CH_4 for on-road vehicles were obtained from the Climate Registry's General Reporting Protocol (Climate Registry, 2008). See Section 3.1, Air Quality and Climate, for a discussion of the assumptions made and methodology of emission calculations.

CO_2 Capture Facility

DOE used AEP's preliminary monthly construction schedule and the associated activity levels of expected construction equipment to calculate the potential GHG emissions during the construction of the CO_2 capture facility. Table 3.2-4 summarizes the calculated total GHG emissions generated by the construction of the CO_2 capture facility. See Section 3.1, Air Quality and Climate, for a discussion of the assumptions made and methodology in calculating emissions.

Table 3.2-4. Estimated CO_2 Capture Facility Construction Emissions – GHGs

GHG	Construction Emissions (metric tons)	Global Warming Potential[a]	Construction Emissions, CO_2-eq (metric tons)
CO_2	10,017	1	10,017
CH_4	0.67	21	14
N_2O	0.3	310	93
		Total	**10,124**

[a] Global warming potential is a measure of how much a given mass of GHG is estimated to contribute to global warming in comparison to an equivalent mass of CO_2. It is used as a multiple to calculate CO_2-eq (UNFCCC, 2010).

CH_4 = methane; CO_2-eq = carbon dioxide equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; GHG = greenhouse gas; N_2O = nitrous oxide

Pipeline Corridors

Construction of the pipeline would be accomplished with typical construction methods and equipment. DOE has calculated the potential GHG emissions from these operations based on the length of the pipeline corridors and expected level of activity to construct the pipeline segments. Table 3.2-5 summarizes the calculated potential range of GHG emissions generated by the construction of the pipeline corridors, dependent on the pipeline length. The range displays construction emissions from the shortest route to the longest route. As shown, DOE conservatively estimates that there would be a maximum of approximately 6,017 metric tons of CO_2-eq emitted during construction of the pipelines. See Section 3.1, Air Quality and Climate, for further discussion of the assumptions made and methodology in calculating emissions.

Table 3.2-5. Estimated CO_2 Pipeline Construction Emissions – GHGs

GHG	Construction Emissions (metric tons)	Global Warming Potential[a]	Construction Emissions[b], CO_2-eq (metric tons)
CO_2	509 to 5,964	1	509 to 5,964
CH_4	0 to 0.3	21	0.6 to 7.0
N_2O	0 to 0.1	310	3.9 to 46.1
		Total	**513 to 6,017**

[a] Global warming potential is a measure of how much a given mass of GHG is estimated to contribute to global warming in comparison to an equivalent mass of CO_2. It is used as a multiple to calculate CO_2-eq (UNFCCC, 2010).
[b] Assumes a range from 2.24 miles of pipeline (to injection wells at Mountaineer Site and Borrow Area) to 26.26 miles of pipeline (to injection wells at Borrow Area, Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract).
CH_4 = methane; CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; GHG = greenhouse gas; N_2O = nitrous oxide

Injection Well Sites

DOE calculated the potential GHG emissions from the construction of injection and monitoring wells, as summarized in Table 3.2-6. The range displayed in the table represents construction emissions from four to eight injection wells required for the project. DOE estimates that at most, approximately 53,217 metric tons of CO_2-eq would be emitted during construction of the injection wells. See Section 3.1, Air Quality and Climate, for further discussion of the assumptions made and methodology in calculating emissions.

Table 3.2-6. CO_2 Injection Well Site Construction Emissions – GHGs

GHG	Construction Emissions (metric tons)	Global Warming Potential[a]	Construction Emissions[b], CO_2-eq (metric tons)
CO_2	26,363 to 52,726	1	26,363 to 52,726
CH_4	1.5 to 3.1	21	32.2 to 64.3
N_2O	0.7 to 1.4	310	214.0 to 427.9
		Total	**26,609 to 53,218**

[a] Global warming potential is a measure of how much a given mass of GHG is estimated to contribute to global warming in comparison to an equivalent mass of CO_2. It is used as a multiple to calculate CO_2-eq (UNFCCC, 2010).
[b] Assumes a 4-month drilling period per well (two wells per site). Emissions range calculated for four to eight wells.
CH_4 = methane; CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; GHG = greenhouse gas; N_2O = nitrous oxide

Total Construction Emissions

Table 3.2-7 presents the total construction emissions for the project, assuming the longest pipeline routes and the maximum estimated number of injection and monitoring wells. The total calculated emissions are based on the preliminary project design and conservative assumptions regarding activity levels and duration and therefore calculated total emissions are likely overestimates of actual emissions.

Table 3.2-7. Estimated GHG Emissions from Construction of the Mountaineer CCS II Project

Construction Equipment and Activities	CO_2-eq Emissions (metric tons)
CO_2 Capture Facility	10,124
Pipeline Corridors[a]	6,017
Injection Well Sites[b]	53,218
Total Construction Emissions[c]	**69,359**

[a] Assumes the longest pipeline routes.
[b] Assumes the maximum estimated number of injection wells.
[c] 69,358 metric tons CO_2 amortized over a 20-year lifespan amounts to approximately 3,468 metric tons per year.
CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; GHG = greenhouse gas;
CCS = carbon capture and storage

The conservatively estimated emissions from construction of the project would produce a total of approximately 69,358 metric tons of CO_2-eq, amortized to 3,468 metric tons over the 20-year lifespan of the project operations. These GHG construction emissions generated during the entire construction phase of this project would amount to approximately 4.6 percent of the projected first year's 1.5 million metric tons of captured CO_2. On a regional scale, this would equate to 0.05 percent of GHG emissions from fossil fuel combustion in the State of West Virginia in the first year of operation, and would be negligible on a national scale. The cumulative impacts of GHG emissions are discussed in Section 4.2, Potential Cumulative Impacts.

Construction activity impacts from GHG tailpipe emissions could be reduced through the use of BMPs, such as reducing or eliminating equipment idling time and using properly maintained equipment.

3.2.3.2 Operational Emissions

The Mountaineer CCS II Project would have a beneficial impact on regional GHG emissions during operations. The project would be designed to capture 1.5 million metric tons of CO_2 annually from the currently operating Mountaineer Plant and permanently store the CO_2 in geological formations. Operation of the CO_2 capture facility would not directly generate GHGs; however, indirect emissions of GHGs would occur as a result of transportation-related exhaust emissions from employee vehicles and truck and rail delivery/removal of materials and wastes. These indirect emissions would be insignificant in relation to the overall reduction in CO_2 emissions due to the project's CCS process. See Section 3.1, Air Quality and Climate, for a discussion of the assumptions made and methodology used to calculate the emissions resulting from operations of the project. As shown in Table 3.2-8, operation of the project would be designed to reduce the GHG emissions from the Mountaineer Plant 235-MW slipstream by approximately 90 percent, which equates to an approximate18-percent reduction of the total CO_2 emissions from the existing Mountaineer Plant.

Current scientific methods do not enable an evaluation of the relationship of reductions in GHG emissions from a specific source with a particular change in either local or global climates. The potential contribution or removal of anthropogenic GHGs to global climate change is inherently a cumulative phenomenon. Section 4.2, Potential Cumulative Impacts, presents a discussion of the potential cumulative impacts related to GHG emissions in this context. This project's reduction in existing CO_2 emissions would potentially generate beneficial impacts in terms of cumulative effects on climate change.

Table 3.2-8. Estimated Annual GHG Emissions and Capture during Project Operation

Source	CO_2-eq (metric tpy) [Reductions in Emissions]
Project Operations Transportation Components	
Materials and Waste Transport, and Employee Transport	880
Capture and Storage	
Average Annual Emissions of CO_2 from Mountaineer Plant[a]	8,507,800
CO_2 Captured from 235-MW Slipstream (and Geologically Stored)	[1,500,000]
Estimated Emissions from Mountaineer Plant after CCS	7,007,800
CO_2 Captured from 235-MW Slipstream	90%
CO_2 Reduced from Mountaineer Plant Emissions	18%
Overall CO_2 Reduction for the Project[b]	18%

[a] Source: EPA 2010e (Calculated average emissions of CO_2 from 2007 through 2009).
[b] Based on the ratio between the CO_2 captured and stored and the total CO_2 emitted from the Mountaineer Plant and project operations
CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; GHG = greenhouse gas; MW = megawatt

3.2.4 Direct and Indirect Emissions of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to GHGs from the existing Mountaineer Plant.

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3.3 GEOLOGY

3.3.1 Introduction

This section identifies and describes geological resources potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources, the potential for CO_2 to migrate from deep geologic formations, and the potential consequences should this occur.

3.3.1.1 Region of Influence

The ROI for geological resources includes the alluvial deposits, bedrock, and economic minerals at and beneath the project site, as well as within the CO_2 geologic storage area. The CO_2 geologic storage area includes the geologic formations that would contain the CO_2 during injection, dissolution and migration within the saline formation (i.e., the CO_2 plume). AEP conducted a preliminary analysis of the anticipated extent of the CO_2 plume. The analysis predicts that, over an assumed 20-year injection life of the project, the plume would have a horizontal radius around each injection well site of approximately 2 miles within the Rose Run Formation and 3 miles within the Copper Ridge Formation. Therefore, the ROI for the geologic storage area has been established as the area within a 3.5-mile horizontal radius of the injection well sites, since it is a reasonable upper bound projection.

In considering potential seismic (i.e., earthquake) effects, the ROI includes the area within 30 miles of the project facilities. This is the distance that a potential seismic event could reasonably result in effects to the project. The 30-mile ROI for potential seismic effects allows for an analysis of earthquakes and potential faults located outside the injection plume ROI and is a common approach used in other geologic sequestration EISs.

3.3.1.2 Method of Analysis

DOE evaluated the potential impacts on specific geologic resources as a result of the construction and operation of the project. Several data sources were used to conduct this analysis, including U.S. Geological Survey (USGS) topographic maps, subsurface seismic studies, reports from the West Virginia Geological and Economic Survey (WVGES), USGS seismicity maps, the UIC Class V well permit application for the existing Mountaineer demonstration CO_2 injection wells (i.e., at the existing PVF), topical reports supporting siting the PVF facility, and results from the PVF facility injection reports. In addition, DOE used the results of the CO_2 storage analysis conducted by AEP that presented the proposed well design, pressure gradients, and CO_2 migration.

3.3.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to geology based on whether the Mountaineer CCS II Project would directly or indirectly

- result in local seismic destabilization (induced seismicity) and damage to structures;
- cause or be damaged by geologic-related events (e.g., earthquake, landslides, mine subsidence, sinkholes);
- reduce the value of mineral resources or render them inaccessible;
- alter unique geologic features or landforms;
- result in the migration of geologically stored CO_2 outside of the confining zone; or
- cause a measureable ground heave or upward vertical displacement of the ground surface resulting in impacts to structures, or other surface or underground features.

The impact analysis presented in Section 3.3.3 describes the potential for impacts based on the above criteria and is supported by the information in the Affected Environment section (see Section 3.3.2). Potential impacts resulting from increased soil erosion or groundwater contamination are addressed in Section 3.4, Physiography and Soils, and Section 3.5, Groundwater, respectively.

3.3.2 Affected Environment

3.3.2.1 CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Surficial Geology

The Mountaineer CCS II Project would be located in the Central Allegheny Plateau major land resource area. Section 3.4, Physiography and Soils, describes the resource area in more detail, (see Figure 3.4-1). The region contains relatively flat bedrock formations with topography that varies from nearly level lowlands to ridgelines bounded by steep side slopes. In most areas, the bedrock is covered by a thin soil column. The soils form in young alluvial material in the valley floors and in weathered bedrock in all other areas. The topography within the ROI is heavily influenced by erosion in the Ohio River watershed. Surface runoff collects in streams and gullies, with increased erosion along the streambeds. Elevations in the ROI range from 540 feet above mean sea level (amsl) at the Ohio River, to 960 feet amsl at the tallest ridges in the ROI.

> Appalachian Plateau Province is the area along the western edge of the Appalachian Mountains represented by a broad upland with steep valleys.
>
> Appalachian Basin is a large physiographic region encompassing most of the Eastern U.S., resulting from continental plate collisions that formed the Appalachian Mountains.

The surface topography in Mason County is extremely variable, with numerous rolling hills and stream-cut valleys leading down gradient to the Ohio River valley. The Mountaineer Plant and Injection Well Site MT-1 are located at approximately 600 feet amsl. The Western Sporn Tract elevations vary between 620 and 840 feet amsl, with the potential injection well sites on this property located at approximately 630 to 660 feet amsl. The Eastern Sporn Tract elevations range from approximately 620 to 860 feet amsl, with the injection well sites on this property located between 800 to 860 feet amsl. The Jordan Tract elevations range between 640 and 930 feet amsl. The Borrow Area property elevations range between 740 and 850 feet amsl. With the exception of the Ohio River valley, the elevation changes, or slopes, within the ROI are relatively steep, with 20 feet of elevation change occurring within a 100-foot distance on most slopes (i.e., 20 percent average slope). In Section 3.4 Physiography and Soils, Figure 3.4-2 overlays the proposed project sites on a USGS 7.5- minute topographic map.

Bedrock Geology

Bedrock in the ROI formed within the Appalachian Basin, a mature sedimentary basin (or geologic depression) in the Midwest U.S. that contains sedimentary rocks 3,000 to 20,000 feet thick (see Figure 3.3-1). The bedrock within the ROI consists of sedimentary rock sequences deposited in the Paleozoic Era (600 to 230 million years ago) over Precambrian basement granite and gneiss (WVGES, 1969). Marine sediments deposited in the Cambrian and Ordovician Periods formed into thick, alternating layers of shale, limestone, dolomite, and sandstone within the basin.

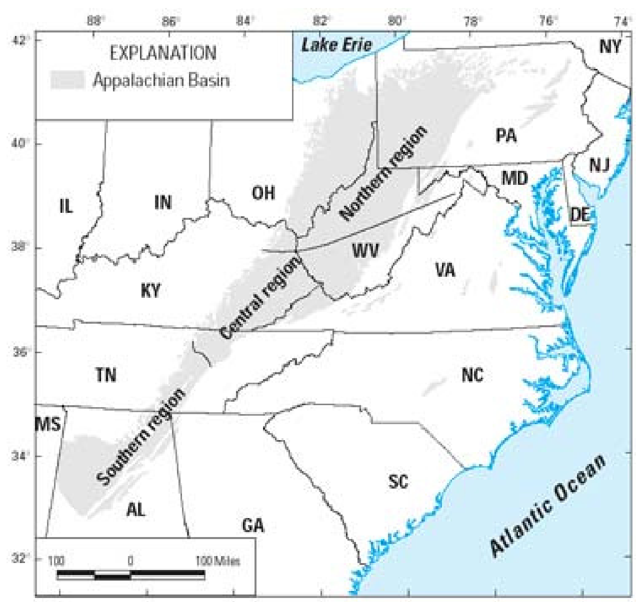

Figure 3.3-1. The Appalachian Basin
Source: Ruppert *et al*, 2002

Figure 3.3-2 presents the bedrock formations found within the ROI. At the base, sequential layers of carbonate rocks alternate with sandstone beds, and gradually grade upward to successive shale beds. Initially, tectonic events in the Ordovician, Silurian, and early Devonian Periods uplifted the land to the east and decreased the ocean depth within the ROI. The sea retreated at the end of the Mississippian Period, which generated low-level, swampy deposits. In the Permian Period, the Appalachian Orogeny formed the Appalachian mountain ranges and started the erosion process that continues today.

In 2003, an exploratory well drilled at the Mountaineer Plant found saline reservoirs in the Rose Run (sandstone) Formation at a depth of 7,706 to 7,822 feet bgs, and within a vuggy horizon of the Copper Ridge Formation at 8,150 to 8,400 feet bgs (AEP, 2008). A combination of log and core analysis and reservoir tests indicated that the permeability and porosity in these formations is suitable for CO_2 injection. The permeability and porosity values are presented in the formation descriptions, below. Additionally, the core tests found thick shale, dolomite, and limestone sequences above the injection formations, which could act as a confining zone (see Figure 3.3-2). Seismic data from the bedrock formations in the confining zone show they are laterally (outwardly) extensive (AEP, 2008). Over 5,000 feet of low-permeability dolomite and limestone, and 1,300 feet of shale, directly overlay these formations.

> A **vug** is a small cavity in rock typically formed by the dissolution of minerals. These may or may not be filled with brine. Horizons that contain a high concentration of interconnected vugs (vuggy zones) can have suitable storage capacity and injectivitiy for CO_2 storage.

A description of the bedrock formations in the proposed confining and injection zones is presented below, from the deepest to the shallowest formations. Figure 3.3-2 shows all of the geologic formations and their respective depths. The formation depths may vary up to 500 feet at the other injection well sites. The permeability and porosity measurements would be verified at the potential injection well sites during the geologic characterization study. From the previous well cores, the two formations with the greatest permeability and porosity are the Rose Run Formation and the vuggy horizons within the Copper Ridge Formation. For that reason, these two formations have been identified as the target injection formations. Because of the potential that impermeable formations above and below the target injection formations could accommodate small amounts of CO_2, the injection zone contains both permeable and impermeable formations, which are described as follows.

> **Injection zone** is a geologic formation, group of formations, or part of a formation with sufficient areal extent, thickness, porosity, and permeability to receive injected CO_2 through a well or wells associated with a geologic sequestration project.
> **Confining zone** is a geologic formation, group of formations, or part of a formation stratigraphically overlaying the injection zone (s) that acts as a barrier to fluid movement.

The proposed injection zone consists of the formations between the St. Peter Formation and the Precambrian granite basement (see Figure 3.3-2). The Precambrian granite basement underlies the Appalachian Basin with an erosion contact between the basement and the sedimentary formations. Above the granite basement is a basal sand unit, located at 9,030 feet bgs with a thickness of about 8 feet, a measured porosity 4 to 9 percent and permeability up to 4 millidarcies (mD). Because of these characteristics, the sand had once been considered as a potential injection formation, but there is currently no indication that it would be used as a target injection formation. The sand unit grades upwards from a thickly bedded fine to medium-grained sand to a sandy dolomite interbedded with dolomite, to the Maryville Formation, which is a dense white to light brown microcrystalline dolomite. Above the Maryville Formation is the Nolichucky Formation, which consists of shale, and is 104 feet thick and located at 8,520 feet bgs. The formation at the PVF test well is light to medium gray dolomite and shale.

The Copper Ridge Formation is located above the Nolichucky formation. Results from the PVF test well shows that permeable horizons within the Copper Ridge Formation may have the characteristics to receive large quantities of injected CO_2. The Copper Ridge Formation contains horizons that consist of vugs, small interconnected cavities, which increase the permeability and porosity within the formation.

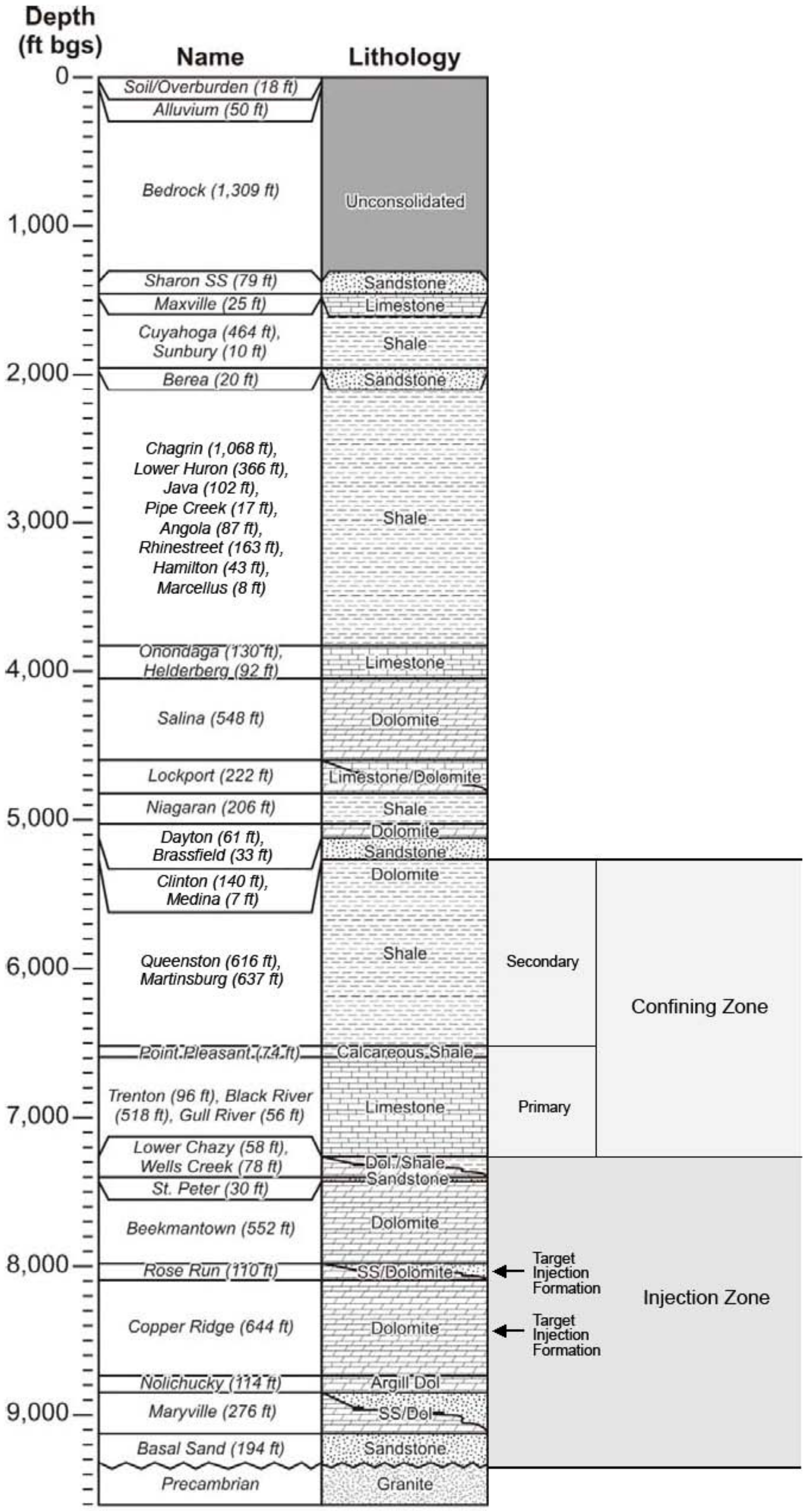

Figure 3.3-2. Summary of the Stratigraphy of West Virginia and the ROI

Note: Thicknesses and depths are approximate.
bgs=below ground surface; ft=feet

The Copper Ridge Formation is 650 feet thick and typically located at 8,100 feet bgs. At the existing PVF, the vuggy horizon within the Copper Ridge Formation is present in several subzones that are approximately 150 feet thick. Data from wireline and core tests of the Copper Ridge Formation show a porosity of 15 percent and a permeability of approximately 708 mD. The vuggy horizon within the Copper Ridge Formation is overlain by the 310 feet of the upper Copper Ridge dolomite matrix, which has a porosity of less than 5 percent and permeability of 0.001 mD (AEP, 2008). Vuggy zones have been identified in other deep wells in the region, which suggests that the highly-permeable horizon could be laterally contiguous and regionally extensive (AEP, 2008). The vuggy horizons within the Copper Ridge Formation would be suitable for injection as they have excellent permeability and thus the ability to transmit fluids, while the surrounding dolomite is less permeable and has very low porosity. As part of the geologic characterization study, the Copper Ridge Formation would be evaluated to determine if hydraulic stimulation would be needed to improve injectivity.

Optimum Geologic Properties:

- High porosity and permeability
- Caprock with low porosity and permeability
- No major faults or fractures
- Structurally simple
- Deep (> 0.5 mile bgs)

Above the Copper Ridge is the Rose Run Formation, a primarily medium-grained, moderate to poorly sorted, feldspar-rich sandstone with interbedded sandy dolomite, typically found at 7,700 to 7,800 feet bgs. Wireline, core, and reservoir tests conducted by AEP in the PVF test well indicated that the Rose Run has a porosity of 8 to 13 percent and a permeability of up to 70 mD (AEP, 2008). These tests suggest that the Rose Run Formation may have sufficient permeability to transmit fluids, while the Beekmantown Formation has lower permeability (0.001 mD) and porosity (0.38 to 0.42 percent) that would prevent the vertical migration of fluids. Formation integrity testing also concluded that the Rose Run Formation has a lower threshold fracture pressure than the surrounding formations, meaning that the formation would fracture at lower pressures than what is needed to fracture the surrounding formations. As the Rose Run Formation is easier to break up than surrounding formations, there exists the potential to use hydraulic stimulation[1], also known as well stimulation, within the Rose Run Formation to increase injectivity, which may be needed to achieve sufficient CO_2 storage volumes for the project.

Above the Rose Run Formation, and at the top of the injection zone is the Beekmantown Formation, a 545-foot thick sequence of dense carbonate rock located at 7,210 bgs. The formation is a light brown and gray dolomite with micro to coarse crystals. The Beekmantown Formation has a porosity of 2 to 3 percent and a permeability of less than 0.001 mD (AEP, 2008). Some variability in porosity has been observed within the formation, with some zones up to 10 percent at 7,330 feet bgs (Battelle, 2008).

The confining zone consists of two groups of formations that have been identified as primary and secondary confining zones. The formations in the primary confining zone include the carbonate and shale layers in the Trenton, Black River, and Gull River Limestone. This zone is 669 feet thick and located directly above the injection zone. The Beekmantown Formation is capped by the Wells Creek shale and unconformity sand, which are extremely variable in their thickness and composition in the area around the AEP plant site. The Gull River Formation is 58 feet thick and located at 6,986 feet bgs. The formation is dense, non-porous medium to light brown microcrystalline limestone (Battelle, 2008). The Black River Formation is 496 feet thick and located at 6,490 feet bgs. This formation is light brown, and very dense with small calcite crystals. The Trenton Formation is 115 feet thick and located at 6,375 feet bgs. It is comprised of dense, light to medium brown limestone with thin beds of gray shales with carbonate minerals. Collectively, the Trenton, Black River and Gull River formations have a permeability of less than 0.001 mD and typical porosity of less than 5 percent, in most cases less than 1 percent (Battelle, 2008).

[1] Hydraulic stimulation is a process where a fluid is injected under high pressure that exceeds the target rock strength. The fluid pressure opens or increases the fractures in the bedrock.

The secondary confining zone consists of the Point Pleasant Formation and Martinsburg Formation, which is overlain in some areas by the Queenston Formation. The Point Pleasant Formation is a transitional shale horizon that is located between the Martinsburg Formation and the Trenton limestone. Above the Point Pleasant Formation is the Martinsburg Formation, which is also referred to as the Utica Formation. The Martinsburg Formation is 1,020 feet thick, located at 5,150 feet bgs. The formation consists of gray shales that are occasionally interbedded with thin beds of limestone. The base of the Martinsburg Formation contains more interbedded limestone and dark brown or black shale. Above the Martinsburg Formation is the Queenston Formation, approximately 616 feet thick and found at 5,060 feet bgs. It is an iron-rich red shale that contains some calcium carbonate minerals (Battelle, 2008). During the geologic characterization survey, the permeability and porosity values will be measured, although they are expected to be similar to those formations in the primary confining zone. Above the secondary confining zone, there is an additional 5,000 feet of dolomite, limestone, sandstone, and shale formations that make up the Appalachian basin bedrock.

At the Mountaineer Plant, the Cambrian-Ordovician bedrock sequence (which includes the Rose Run and Copper Ridge Formations) consists of flat-lying, parallel beds that tend to follow the underlying and gently dipping Precambrian surface. Approximately 20 miles south of the Plant, younger formations of Mississippian and Devonian age form a structural sequence that shows evidence of trapped oil and gas (Overbey, 1961). These structural features do not continue to the northern border of Mason County, nor are they observed in the deeper local bedrock formations.

Mineral Deposits

Relatively shallow formations in the Appalachian Basin have been mined for coal and drilled for oil and natural gas. West Virginia is well known for its coal seams that have been mined for well over a hundred years. In Mason County, there are over 177 records of surface and underground coal mines (WVGES, 2010a). Historically, most of the coal has been extracted from the Redstone and Pittsburgh seams, which are part of the Monongahela Group, a Pennsylvanian-aged bedrock sequence. The closest coal mines to the Mountaineer Plant are the Broad Run Mine (also known as the Flint Hill Mine) located less than 1 mile to the south, and an unnamed historic surface mine approximately 2.5 miles to the northwest (WVGES, 2010a). The Broad Run Mine is not currently in operation. Numerous historical coal mines occur around Syracuse, Ohio, including the Syracuse Slope, Pomeroy, Mine No. 75, and Mine No. 74 (Ohio Geological Survey, 2010). The Redstone coal seams around New Haven are typically 36 to 48 inches thick and located 520 to 560 feet bgs (WVGES, 2010a). The closest occurrence of the Pittsburgh coal seam is found outside the ROI in the southeast corner of Mason County.

In addition to coal deposits, the Appalachian Basin also has several oil and natural gas fields. However, most of the oil and gas development has occurred in the counties surrounding Mason County, as Mason County contains more shales than oil- and gas-bearing sands. The surrounding counties have shallow geologic anticlines, synclines, and dome structures that trap the petroleum products. Northern West Virginia contains many more oil and gas wells than are found in the ROI.

Wells within ROI

Oil and gas exploration began in the region in the 1880’s and in 1930 in Mason County. The number of wells expanded in the 1920’s and gradually increased with new discoveries (Overbey, 1961). Today, there are more than 500 active wells; however, these wells are not as active as during prior years. Most of the wells are drilled into the Pennsylvanian, Mississippian, Devonian, or Silurian sand deposits.

The Ohio and West Virginia Oil and Gas well databases were queried for wells within 3.5 miles of the potential injection well sites, with the results presented in Figure 3.3-3. In West Virginia, there are a total of 109 wells within 3.5 miles of the injection well sites. Of these wells, 10 are abandoned but not plugged, 37 are plugged, 34 are active, 4 are permitted, 4 are under construction, and 20 are unknown. Active wells are those in production within the last 2 years. Abandoned but not plugged wells are wells

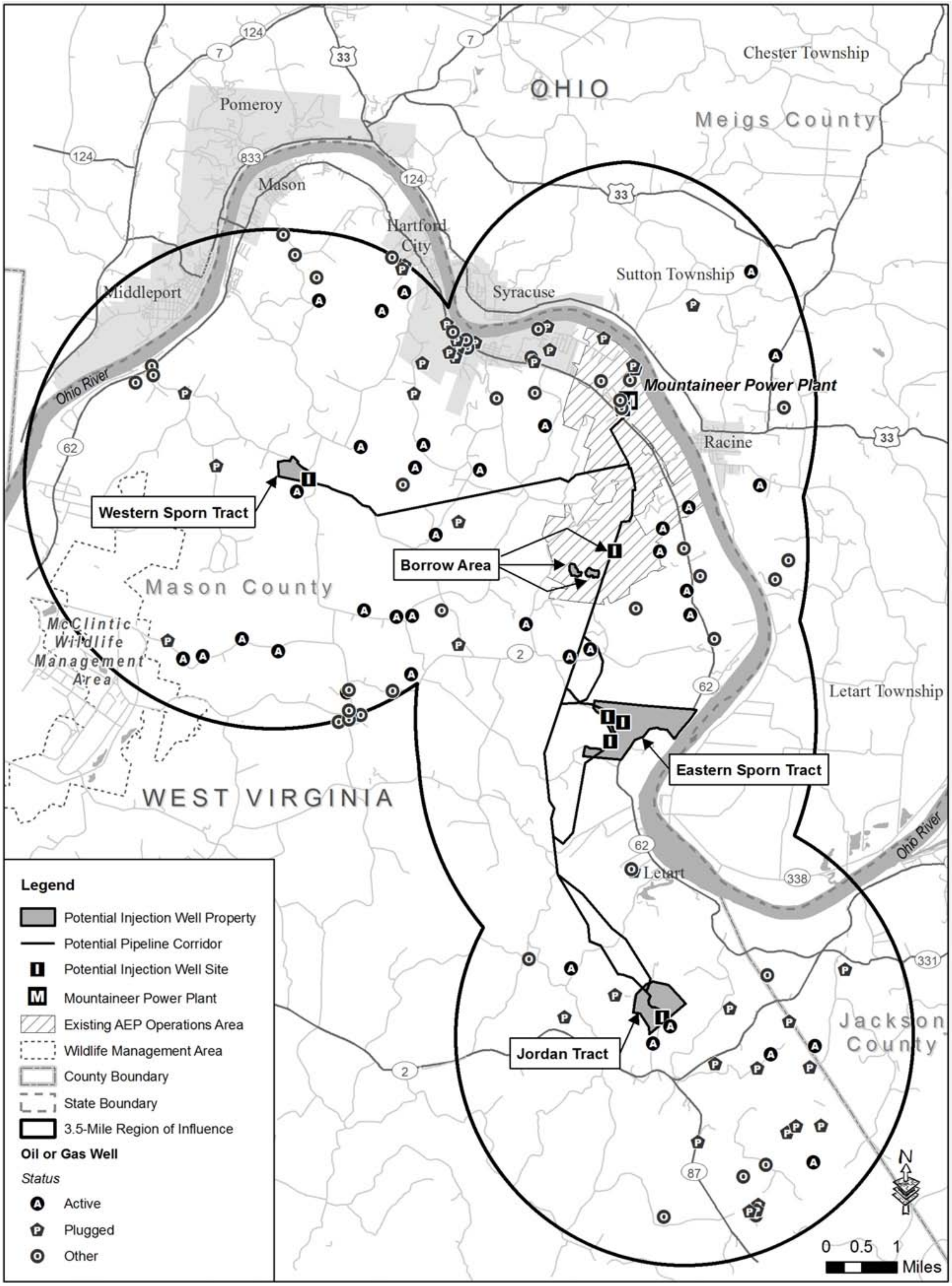

Figure 3.3-3. Oil and Gas Wells within 3.5 Miles of the Potential Injection Well Sites

that have not been active, but the documentation to plug them has not been submitted to the WVDEP. Unknown wells are typically wells that are so old that neither the WVDEP nor the WVGES have any information about them other than their location. In Ohio, there are seven wells within 3.5 miles of the injection well locations. One of the wells is plugged, with four producing wells, and two wells that were permitted through the Ohio Division of Mines (ODNR, 2010a).

With the exception of AEP's existing PVF injection and monitoring wells on the Mountaineer Plant property, the deepest well within 3.5 miles of the injection well sites is an oil well at approximately 5,200 feet in depth, which is 2,500 feet above the top of the Rose Run Formation. Of the other 116 non-AEP oil or gas wells reported in the review area, 2 wells (1 plugged and 1 active) have depths between 5,000 and 5,200 feet bgs. Ten wells are drilled to depths between 4,000 and 5,000 feet bgs. Thirty-one wells are drilled to 3,000 to 4,000 feet bgs. Thirty-five wells have no depth data, although it is unlikely that they are drilled to depths greater than 5,000 feet bgs because they are either plugged, never drilled or currently under construction. The rest of the wells are shallower than 2,000 feet bgs (WVGES, 2010b).

The deepest wells within the 3.5-mile radius ROI are the two PVF injection wells at the Mountaineer Plant. AEP drilled the first test well in 2003 to a depth of 9,100 feet bgs (AEP, 2008). This well was first used by AEP to characterize the local injection horizons and upgraded in 2009 to inject CO_2 into the Copper Ridge Formation as part of the PVF project. In 2009, AEP drilled a second injection well at the Mountaineer Plant into the Rose Run Sandstone Formation to a depth of approximately 7,750 feet bgs.

AEP also installed three deep monitoring wells at the Mountaineer Plant as part of the PVF project. These wells are used to conduct monitoring in accordance with the Class V UIC permit that was issued in 2009. Two wells are drilled into the Rose Run Formation, and one into the Copper Ridge Formation (Battelle, 2010). These wells are used to monitor the temperature and pressure of the injection reservoir fluid during injection. These monitoring wells extend to a depth of 7,700 to 8,400 feet bgs.

The EPA uses the UIC Program and the Safe Drinking Water Act (SDWA) to regulate injection wells by defining the operating parameters and monitoring requirements. The UIC Program requires identification of USDW that could be affected by an unintended release of the injected material. The USDWs in the ROI are primarily confined to the alluvial materials in the Ohio River valley-fill (alluvial) aquifer. Deeper bedrock aquifers are also present in the sandstones of the bedrock column. Section 3.5, Groundwater, describes the USDWs around the Mountaineer CCS II Project in more detail. As described in Section 3.5, Groundwater, drinking water wells in the ROI are typically drilled to depths of 250 feet bgs or less. Deeper bedrock aquifers in the ROI have high total dissolved solids (TDS) concentrations that preclude their use as drinking water.[2] Therefore, the USDW depth limit is 250 feet bgs.

Seismic Activity

Prior to the PVF project, AEP completed a two-dimensional seismic study at the Mountaineer Plant. This study used seismic reflection along two transects that intersected at a point off the Mountaineer Plant property. Small seismic waves generated from mobile sources were reflected from formations with different compositions, producing reflected seismic waves at different speeds. When the seismic waves are measured along a transect, the results show differences in formation composition, faults, or larger structural features. The use of two transects helps to define the structure and dip of the formations in a larger area. The Mountaineer transects included a 4.5-mile northwest-southeast run and a 6.6-mile northeast-southwest run. The data were calibrated with the wireline sonic log at the PVF test well. No faults were identified by the seismic study.

The closest regional fault system, the Rome Trough, is located approximately 25 miles southeast of the Mountaineer Plant. The Rome Trough consists of a sequence of normal faults in the Precambrian

[2] Baseline sampling of the saline reservoir in the Rose Run and Copper Ridge Formations for the PVF injection wells found a TDS concentration of approximately 300,000 milligrams per liter for each formation, well above the limit for USDW (Battelle, 2010).

basement bedrock. The faults occur at 10,000 feet bgs and deeper, and have no surface expression (AEP, 2008). The basement faults may have been reactivated during the creation of the Appalachian Mountains; however, there has been no evidence of reactivation in the last 306 million years (Kulander and Ryder, 2005). The faults are also located downdip of the injection well sites and are restricted to the deeper Cambrian/Precambrian-age rocks, over 1,000 feet deeper than the target injection formations.

Since 1973, there have been four recorded earthquakes within a 30-mile radius of the Mountaineer Plant, all of which were at or below magnitude 3.5. Earthquakes of this magnitude can occasionally be felt, but do not typically cause damage to well-built surface structures. The closest earthquake was magnitude 2.8 that occurred southeast of Racine, Ohio on May 6, 2002, approximately 3 miles southeast of the Mountaineer Plant. Two earthquakes occurred approximately 20 miles away from the Mountaineer Plant: in 1974, a 3.4-magnitude earthquake occurred between Racine and Mineral Wells, Ohio, 20 miles northeast of the Mountaineer Plant; and on April 24, 2009, a 3.3-magnitude earthquake occurred 21 miles southwest of the Mountaineer Plant (USGS, 2010a). In 1975, approximately 23 miles to the northwest, a 3.4 magnitude earthquake occurred outside of Jackson, Ohio.

Through the National Earthquake Hazard Reduction Program, the USGS generated a geologic seismic hazard probability database to estimate the potential for earthquakes in the U.S. The database uses known fault sequences and historical earthquake data. Models generated from the database show the probability of a damage-inducing earthquake at a specific location. According to this database, the Mountaineer Plant has a zero percent chance that a magnitude 5.0 or greater earthquake would occur in the next 50 years (USGS, 2010b). For the shaking hazard potential in the next 50 years at the Mountaineer Plant, there is a 2 percent chance of an event that would cause shaking of structures that could cause minor structural damage (USGS, 2010c). This is equivalent to a peak acceleration of 4 percent of the gravity coefficient over 50 years (i.e., the ROI is considered seismically stable).

Current Injection Activities

The PVF is the first CO_2 capture and storage project within West Virginia. AEP constructed the PVF at the Mountaineer Plant in 2009 to test CO_2 capture and geologic storage in a small-scale validation study (approximately 100,000 metric tpy). The UIC Class V experimental well permit for the PVF injection wells was submitted to the WVDEP in February 2008 and preliminary injection started in early October 2009. The CO_2 captured at the Mountaineer Plant is being injected into the Rose Run and Copper Ridge Formations (Battelle, 2010). Under the conditions of the UIC permit, AEP regularly monitors the CO_2 injection and containment system. This monitoring includes: quarterly CO_2 injectate sampling, continuous injection pressure and temperature monitoring, continuous injection reservoir pressure monitoring, quarterly groundwater monitoring, annual external mechanical integrity testing, annual cross-well seismic profiling, and annual injection saline reservoir fluid testing (Battelle, 2010).

AEP also installed three deep monitoring wells into the Rose Run and Copper Ridge Formations at the Mountaineer Plant. These wells are used to monitor the chemical composition, temperature, and pressure of the CO_2 storage reservoirs. The chemical composition of the target injection formations is discussed in Section 3.5, Groundwater. Continuous monitoring of the temperature and pressure during injection helps to determine the injected CO_2 behavior within the injection horizons. This monitoring has shown

- the bottom hole pressures in the monitoring wells do increase with the start of injection;
- there is no identified connectivity between the Rose Run and Copper Ridge Formations;
- the analysis of reservoir response and pressure decline from ongoing injection activity will help to determine system boundaries and reservoir type; and
- the pressure increase is well below the stress fracture pressures of the formation (Battelle, 2010).

According to AEP, approximately 1,500 metric tons of CO_2 were injected into the Rose Run Formation and 13,500 metric tons were injected into the Copper Ridge Formation through August 2010, for a total of approximately 15,000 metric tons.

Successful CO_2 sequestration in saline formations has occurred at Sleipner (Norway), Weyburn (Canada) and at field tests in Decatur, Illinois, Gaylord, Michigan, and other locations across the U.S. The potential for CO_2 storage in West Virginia has been assessed by the MRCSP, which estimates that 60,810 million metric tons of CO_2 could be stored within geologic reservoirs in the state (Carbon Dioxide Working Group, 2010). A separate National Energy Technology Laboratory review of the CO_2 storage potential in West Virginia estimated between 4,900 and 15,000 million metric tons of CO_2 storage capacity (NETL, 2008), which does not include oil shales as potential storage formations.

3.3.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to the geology based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.3.1.3.

3.3.3.1 Construction Impacts

CO_2 Capture Facility

Construction of the CO_2 capture facility at the Mountaineer Plant would not affect geologic resources. The new facility would be built on the existing Mountaineer Plant property, in an area that has been previously disturbed from construction activities.

Pipeline Corridors

There would be minor impacts to geological resources from construction of the proposed pipeline corridors. The pipeline routes would use existing electrical transmission line corridors as much as possible, and would be designed similar to natural gas pipelines, which are common in Mason County. All pipelines would be located underground, except where pipeline segments would cross vertical rock outcrops. In some locations with shallow bedrock, tractor ripping may be used to excavate the pipeline trench. In those areas where bedrock cannot be ripped or excavated, blasting may be required. Blasting would be performed in accordance with state regulations and industry BMPs to minimize ground vibrations. Section 3.12, Noise, discusses the potential for impacts from additional noise and vibration during construction.

Construction of the pipeline corridors would not affect any surface or underground mining operations. Construction over irregular terrain may require stabilization efforts to ensure that no landslides or ground instability would be induced as a result of construction. Careful corridor selection and standard pipeline construction BMPs (see Section 2.3.4.3) would ensure that construction would not reduce the local ground stability.

Injection Well Sites

There would be minor impacts to geological resources from the construction of the proposed injection wells. To construct each injection well, drills would remove soil and subsurface rock to insert the well casing. The soil and rock that would be removed during the drilling process is not considered unique to the region, and would not affect the availability of local geologic resources. Some alluvial material may be required to construct the access roads to the injection well sites; however, the amount of material used would not affect local alluvial material resources. Drilling and installation of the injection wells would not induce seismicity or cause damage to structures.

Based on the existing limited data from injection and the known characteristics of the injection zone, hydraulic fracturing, or "well stimulation", may be needed to increase injectivity in one or both target formations. Although well stimulation is exempted from the SDWA, the WVDEP Office of Oil and Gas requires companies performing well stimulation to submit additional information as an addendum to the well work permit application (WVDEP, 2010b). In the event that well stimulation would be needed, AEP would prepare and submit a detailed plan to the WVDEP for review and approval.

While construction of the injection wells would necessarily alter the subsurface geology within the target injection formations, construction would not be likely to result in seismic activity that could damage structures, impact high-value or unique geologic resources so that they are inaccessible, or cause measurable displacement of the ground surface. As part of the UIC permitting process, AEP would likely be required by the EPA or WVDEP to install monitoring wells (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the geological characterization work. AEP anticipates the need for one to three deep monitoring wells per injection well, or per co-located pair of injection wells. Construction of each monitoring well would result in impacts similar to those described for the construction of the injection wells.

3.3.3.2 Operational Impacts

CO_2 Capture Facility

There would be no impact to geologic resources from operation of the proposed CO_2 capture facility at the Mountaineer Plant. The alluvial material and bedrock geology would not be disturbed during operations. Operation of this project would not likely result in any seismic effects that could damage structures, impact high-value or unique geologic resources so that they are inaccessible, or cause measurable displacement of the ground surface.

Pipeline Corridors

There would be no impact to geologic resources from the operation of the proposed CO_2 pipelines. Pipeline repairs or maintenance may be required during operation; however, these activities would only disturb the surficial material and soils that were previously disturbed during construction of the pipeline. Operation of this project component would not be likely to result in any seismic effects that could damage structures, destruction of high-value or unique geologic resources, render any such resources inaccessible, or cause displacement of the ground surface.

Injection Well Sites

Although the injection of CO_2 into the target formations would modify the ambient conditions of those formations, it would not result in seismic effects that could damage structures. Potential impacts could result in the event that CO_2 migrates through the confining zone; however, such an event is very unlikely based on site selection and injection system design. The potential for migration to occur would depend upon the caprock integrity and reliability of well construction and capping methods. The mechanisms that could allow migration of injected CO_2 include

- CO_2 migration via a transmissive fault;
- CO_2 escapes through permeable zone in the caprock;
- injected CO_2 increases reservoir pressure enough to reactivate an existing but unknown fault;
- CO_2 migration via improperly abandoned or unknown wells; and
- CO_2 migration through an existing injection, monitoring, or characterization well.

The proposed injection zone is over 7,000 feet beneath the earth's surface. Because the injected CO_2 would be less dense than the brine in the target formation, it would migrate within the target formations until, respectively, it reaches impermeable caprock and the pressures equilibrate. CO_2 injected into the Rose Run Formation would be initially capped by the Beekmantown Dolomite. Although the Beekmantown Formation is thick enough to contain the CO_2, the base of the formation would come in contact with the CO_2 plume, which is why it is included in the injection zone. Above the Beekmantown Dolomite, the primary and secondary confining zones are composed of shale and dolomite, including the

Ordovician-age Martinsburg Shale, which is over 1,000 feet thick. The primary and secondary confining zones would prevent the vertical migration of CO_2.

Over time, the CO_2 would move laterally within the target formation until pressure is equilibrated, unless it found a more permeable conduit, (e.g., a transmissive fault). Preliminary seismic surveys of the bedrock around the Mountaineer Plant have shown that the formations within the confining zone are laterally continuous, with no faults. The surveys have also shown that the formations have a slight dip, which would minimize lateral movement (AEP, 2008; Battelle, 2008). Therefore, it is unlikely that the CO_2 would bypass the confining zone (AEP, 2008). In addition, AEP would perform or procure additional seismic surveys as part of the geologic characterization process for the project to confirm that each site is adequately capped.

Aside from the two PVF injection wells, the deepest existing wells in the ROI are drilled to a maximum depth of approximately 5,200 feet bgs. These wells are discussed in more detail in Section 3.3.2.1. Thus, with the exception of the PVF wells, there are over 2,000 feet of unpenetrated shale and limestone between the injection horizons and the deepest wells within the ROI. In addition, while the potential Mountaineer Plant injection wells would be located near the existing PVF wells, the PVF wells are designed with CO_2-resistant concrete to prevent vertical migration along the well. Therefore, it is unlikely that the CO_2 would migrate via other deep wells.

The CO_2 plume is anticipated to move laterally with limited vertical movement within each target injection formation (AEP, 2008). As the CO_2 is injected into the formation and brine is forced laterally away from the injection well, pressures would increase within the storage formations of the injection zone. The increase in pressure in response to the CO_2 injection has been verified at the PVF wells (Battelle, 2010). During the injection characterization process, AEP would use models to predict the extent of the CO_2 and brine pressure plumes during injection. Over time, as the CO_2 is dissolved into the formation brine and as pressures equalize within the target formation, the pressure within the formations would normalize, which would reduce the potential for CO_2 migration.

The injection wells for the PVF are currently undergoing injection and monitoring. AEP would use the results from the PVF project to guide the operation and monitoring procedures for any future injection wells. As stated above, monitoring of the initial injection has shown that the formation pressure does increase, but is below the fracture pressure of the formations. Monitoring to date has also shown that there is no identified connectivity between the Rose Run and vuggy horizons within the Copper Ridge Formation, and there is no sign of CO_2 migration through the caprock (Battelle, 2010). Since PVF injection started in October of 2009, there has been no detectable seismic activity around the Mountaineer Plant (USGS, 2010a).

As there are no major fault sequences in the ROI and the injection pressure would be well below the fracture pressure of the formations within the injection and confining zones, seismic effects are unlikely. Prior to injection, well stimulation, using industry BMPs, could be used to improve injectivity for the target formations. Seismic surveys have shown that there are no cross-formation faults around the Mountaineer Plant. These faults would be susceptible to movement from the increased pressure resulting from well stimulation. Therefore, it is very unlikely that CO_2 injection or well stimulation would cause increased seismicity in the ROI.

As part of the UIC permitting process for the project, AEP would outline the operational BMPs and storage monitoring procedures that would be used to minimize the impacts from injection. During the operational life of the project, AEP would comply with requirements of the UIC permit to monitor the injection formation. Depending on the conditions stipulated in the final UIC permit, one to three deep monitoring wells would likely be constructed within a few thousand feet of each of the injection well sites (see Section 2.3.6 for a discussion of potential monitoring requirements and methods). A monitoring program would be developed to verify the behavior of the CO_2 plume compared to what was predicted by computer modeling and track the distribution of the CO_2 within the injection zone. On-going monitoring would serve as a major component in reducing the potential for impacts to geological resources from the project. No impacts to the geologic resources from operation of the monitoring wells would be anticipated.

The injection wells would be designed to minimize the potential for vertical CO_2 migration along the well. The design would be similar to that used by the PVF injection wells, as described in the PVF UIC permit (WVDEP, 2009d). Table 2-11 presents an example of a typical casing string sequence for the injection wells. Each well would have sequentially smaller casing diameters within the bedrock, and would be sealed with cement to the surface. CO_2-resistant cement would be used from the depth of the well bore to the next shallowest casing depth, approximately 3,800 feet bgs. The use of CO_2-resistant cement in the bottom casing would minimize the potential for CO_2 to degrade the cement and migrate vertically upwards along the well bore.

While operation of the proposed injection wells would necessarily alter the subsurface conditions within the target formations, operation of the injection wells would not be likely to result in seismic effects through damage to structures, cause or be damaged by geologic-related events, impact high-value or unique geologic resources so that they are inaccessible, or causing detrimental displacement of the ground surface. AEP would conduct extensive studies and monitoring, in accordance with the UIC Permit, to minimize this potential long-term impact and have in place the appropriate mitigation strategies should such CO_2 migration be identified.

3.3.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to geological resources.

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3.4 PHYSIOGRAPHY AND SOILS

3.4.1 Introduction

This section identifies and describes the physiography and soils potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources.

3.4.1.1 Region of Influence

The ROI (or study area) for potential impacts to physiography and soils is defined as areas that could be disturbed under the Proposed Action. These areas include the footprint of the CO_2 capture facility, the ROW of the potential pipeline corridors, and the footprint of the injection well sites. Disturbances to physiography and soils outside of these areas are not expected.

3.4.1.2 Method of Analysis

DOE reviewed the following references to obtain information on the physiography and soils that may be affected by the project: the *Soil Survey of Jackson and Mason Counties, West Virginia* (USDA, 2008) and the *Soil Survey Geographic Database* (USDA, 2010). In addition, DOE conducted a wetland delineation in the study area during the 2010 summer season (see Appendix E) in which both wetland (hydric) and upland soils were examined, recorded, and compared to the soils mapped in the *Soil Survey of Jackson and Mason Counties, West Virginia* (USDA, 2008). DOE also conducted a Phase I archeological and architectural survey in the study area (see Appendix H) where soils were examined in shovel test pits (STPs) along the pipeline corridors and within the injection well sites. Soil color and texture of each cultural or diagnostic horizon were recorded according to U.S. Department of Agriculture (USDA) methodology within each STP.

Quantitative estimates of the potential for loss of soil resources were calculated using geographic information systems (GIS) and existing land cover data. Qualitative assessments were made on the potential effects on physiography and soils based on individual soil properties and the expected attributes of the project. The following types of questions were considered during the analysis of the affected environment within the study area:

- What is the distribution of soil units within the ROI?
- Are the soils characterized by high potential for surface runoff and erosion, or soils with very steep slopes?
- Are there soils that have severe restrictions (other than very steep slopes) for development such as high shrink/swell potential or shallow depth to bedrock?
- What is the distribution of prime farmland or farmland of statewide importance located within the ROI?
- Are there any urban soils (soils already impacted by development) within the ROI?

3.4.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to physiography and soils based on whether the project would directly or indirectly

- temporarily or permanently disturb soils during the construction process;
- disturb soils with moderate to very severe potential for surface erosion;
- disturb soils with medium to very high potential for surface erosion;

- disturb soils listed as prime farmland or farmland of statewide importance; or
- disturb soils on land surfaces with slopes in excess of 8 percent.

The analysis of potential impacts also took into consideration whether BMPs would be implemented to reduce erosion and soil disturbance, and whether any measures would be taken to avoid or minimize potential impacts to sensitive soils or soils listed as prime farmland or farmland of statewide importance.

Due to the large scope of this analysis and the number of different soil units within the study area, the highly erodible land (HEL) rating or the potentially highly erodible land (PHEL) rating was used to assess impacts to soils in steep terrain and with various degrees of erodibility. The HEL rating uses a calculation that takes into account each soil's erodibility and soil loss tolerance. The soil erodibility is estimated using the Universal Soil Loss Equation[1] that combines a rainfall and runoff factor, a susceptibility to water erosion factor, and a combined effect of slope length and steepness factor. The soil loss tolerance represents the maximum annual rate of soil erosion that could take place without causing a decline in long-term productivity. The erodibility index[2] for sheet and rill erosion considers all of these factors and is used to determine if a soil unit is HEL or PHEL (UDEL, 2010).

3.4.2 Affected Environment

The following discussion provides a general description of physiography and soils, while Sections 3.4.2.1, 3.4.2.2, and 3.4.2.3 provide a more detailed description of these resources within the proposed CO_2 capture facility, pipeline corridors, and injection well properties, respectively.

As previously stated in Chapter 2, AEP identified preferred locations for the injection wells based on preliminary environmental screening criteria (see Section 2.3.1). It is possible that alternate sites within the same property would need to be considered. For this reason, this section discusses the physiographic and soil resources for each entire property. Section 3.4 focuses on the potential impacts to physiographic and soil resources within the preferred locations for injection well sites within each property (requiring approximately 5 acres for construction and 0.5 acre for operations).

Affected environment and potential impacts to physiography and soil resources were assessed along pipeline corridors using a 120-foot wide construction ROW. As mentioned in Section 2.3.4.3, the anticipated construction ROW would range from 80 feet up to 120 feet, and up to a maximum of 144 feet in very steep areas. For analysis purposes, a 120-foot ROW width was assumed.

Physiography

The study area lies completely within the Central Allegheny Plateau Major Land Resource Area, a physiographic section of the larger Appalachian Plateau province. Figure 3.4-1 depicts the Central Allegheny Plateau and the project location. Elevations in the study area range from 500 feet amsl along the Ohio River to 1,260 feet amsl at the top of Garnes Knob. Most of the topography consists of nearly level to moderately steep ridge tops, and steep to very steep side slopes. Many side slopes contain one or more narrow benches, hence the term "bench-break topography." The eastern portion of the study area is a part of the Ohio River Valley, and consists of nearly level to strongly sloping areas, typically in long bands that follow the river or stream channel. Non-flooding terraces, some representing streams that no longer exist, are relatively broad, occurring on gently sloping to strongly sloping areas (USDA, 2008). Figure 3.4-2 depicts the topographic relief within the study area.

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1 The Universal Soil Loss Equation combines a rainfall and runoff factor (R), a susceptibility to water erosion factor (K), and a combined effect of slope length and steepness factor (LS). The soil loss tolerance (T-value) represents the maximum annual rate of soil erosion that could take place without causing a decline in long-term productivity.

2 The erodibility index for sheet and rill erosion is represented by the formula RKLS/T. A soil unit is highly erodible (thus HEL) if the RKLS/T value using the minimum LS factor is equal to or greater than 8. A soil unit is potentially highly erodible (thus PHEL) if: (1) the RKLS/T value using the minimum LS factor is less than 8, and (2) the RKLS/T value using the maximum LS factor is equal to or greater than 8 (UDEL, 2010).

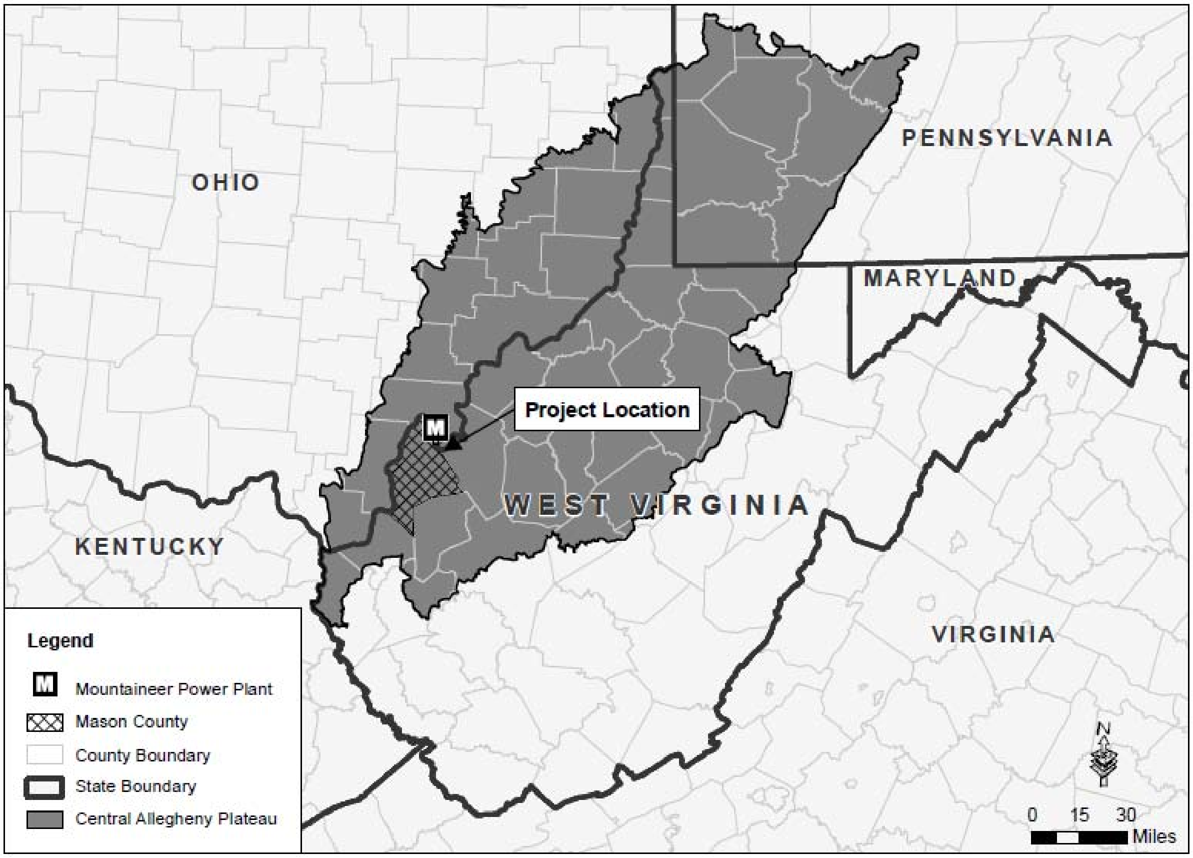

Figure 3.4-1. Central Allegheny Plateau

Soils

Parent Materials in the Study Area:
Residuum – developed in place from underlying rock.
Colluvium – materials (often rocks) transported by gravity.
Eolian–materials transported by wind.
Alluvial–materials transported by water.

The soils in the study area formed in residuum, colluvium, eolian, and alluvial materials, have been mapped as individual soil units (USDA, 2008). See Appendix E for soil maps of the study area. Each soil unit represents an area dominated by one or more soil series or miscellaneous areas.[3] A soil unit is identified and named according to the taxonomic classification of the dominant soil or soils. However, the soil unit also includes minor soils that belong to taxonomic classes other than those of the major soil or soils. The discussion of soil units below includes the approximate distribution of major soils and minor soils, called inclusions. When these inclusions have soil properties that contrast with those of the major soil and they have implications for the analysis in this EIS, they have been listed in Table 3.4-1. Examples of this would be soils with severe hazards of erosion. Figure 3.4-3 displays the locations of the HEL and PHEL soils within the study area.

Some soil units are made up of two or more major soils or miscellaneous areas. These soil units are complexes or undifferentiated groups. A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Gilpin-Upshur complex, 25 to 35 percent slopes (GpE), is an example.

3 Some of the soil units include miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. The soil unit Landfill (Ld) is an example (USDA, 2008).

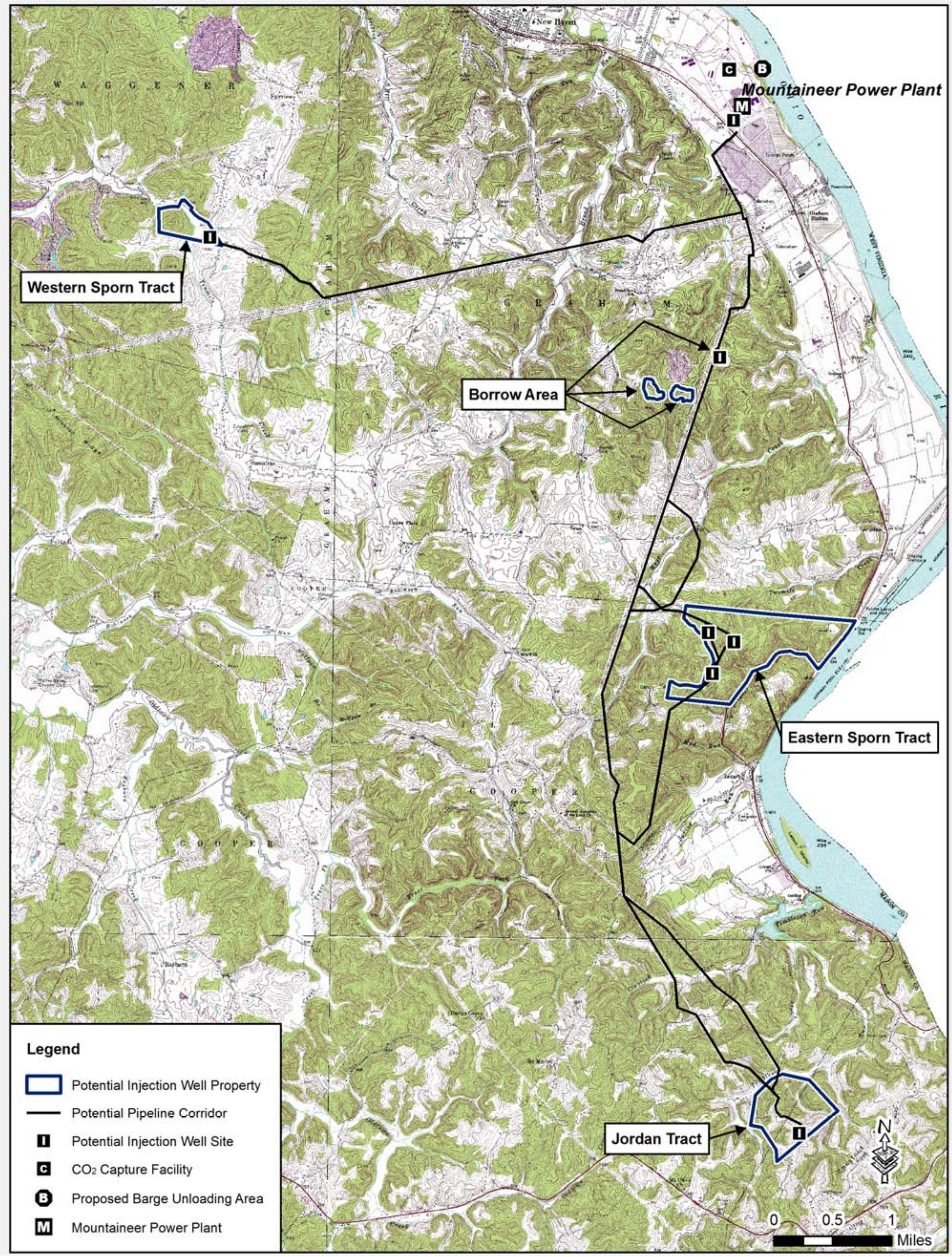

Figure 3.4-2. New Haven, Cheshire, and Mount Alto USGS 7.5-Minute Quadrangle

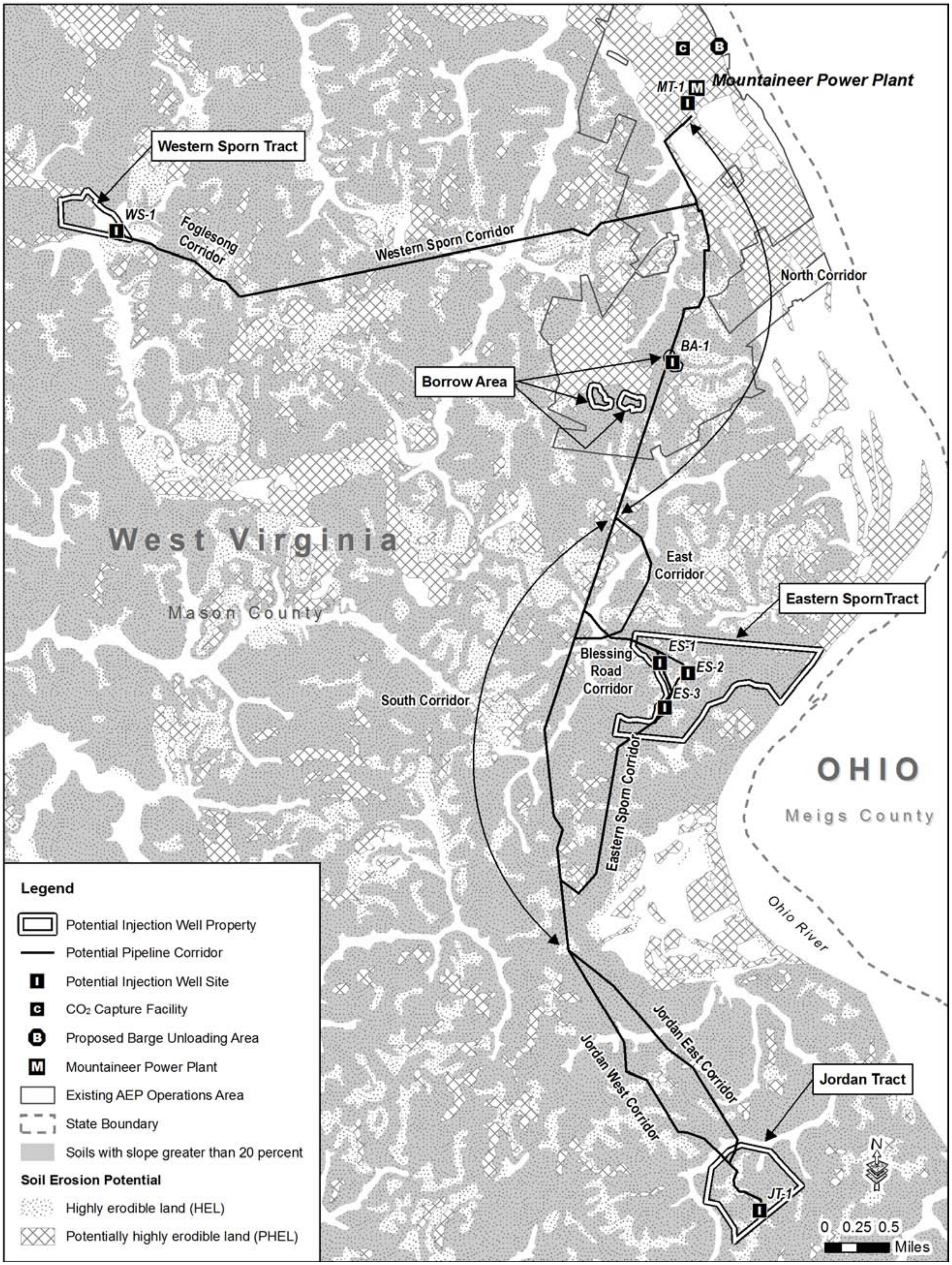

Figure 3.4-3. Soil Erosion Ratings and Slopes Overview

An undifferentiated group is made up of two or more soils or miscellaneous areas that could be mapped individually, but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Coolville and Tilsit soils, 3 to 8 percent slopes (CsB), exemplify an undifferentiated group in the study area. Most of the soil units are phases of a soil series. The name of a soil phase commonly indicates a feature that affects use or management (e.g., Sensabaugh loam, 3 to 8 percent slopes, rarely flooded [SrB]).

Prime Farmland and Other Important Farmlands

Prime farmland and farmland of statewide importance within the study area are listed in Table 3.4-1, and their location and extent are shown in the detailed soil maps in Appendix E. Prime farmland soils are protected under the Farmland Protection Policy Act (FPPA) 7 USC 4201 *et seq*. of 1981. The intent of the Act is to minimize the extent to which federal programs contribute to the unnecessary or irreversible conversion of farmland soils to nonagricultural uses. The Act also ensures that federal programs are administered in a manner that, to the extent practicable, would be compatible with private, state, and local government programs and policies to protect farmland. The Natural Resources Conservation Service (NRCS) is responsible for overseeing compliance with the FPPA and has developed rules and regulations for implementing the Act (see 7 CFR 658, revised January 1, 1998).

Prime farmland soils, as defined by the USDA, are soils best suited for growing food, feed, forage, fiber, and oilseed crops. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment. Soils categorized as prime farmland usually receive an adequate and dependable supply of moisture from precipitation, have acceptable pH levels, have few or no rocks, and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and are not frequently flooded during the growing season. The slopes range mainly from 0 to 5 percent.

In some areas, land that does not meet the criteria for prime farmland is considered to be farmland of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agencies. Generally, this land includes soils that nearly meet the requirements for prime farmland and that economically produce high crop yields when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by state law (USDA, 2008).

Soil Units within the Project ROI

Figure 3.4-4 shows the distribution of the soils in a physiographic setting typical for the study area. Table 3.4-1 contains a description of soil units and related properties mapped within the ROI for the Mountaineer CCS II Project. The following soil properties are presented in Table 3.4-1:

- **Shrink-swell potential** refers to the extent to which a specific soil would expand when wet and retract when dry. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the shrink-swell potential is moderate or higher, shrinking and swelling can cause damage to buildings, roads, and pipelines.
- **Hazard of erosion** refers to the susceptibility of a soil to erosion. Soil erodibility is dependent on factors such as soil texture, permeability, organic matter content, climate, and precipitation events. The classes are none, slight, moderate, severe, and very severe.
- **Surface runoff** refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. It is assumed that the surface of

the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

- **Depth to bedrock** refers to the depth to solid rock underlying the unconsolidated soil stratum. Shallow depth to bedrock could restrict construction activities, such as the excavation of pipeline trenches.
- **Highly erodible land (HEL)/potentially highly erodible land (PHEL)** is discussed in Section 3.4.1.3.
- **Prime farmlands and farmland of statewide importance** are discussed previously under *Prime Farmland and Other Important Farmlands*.

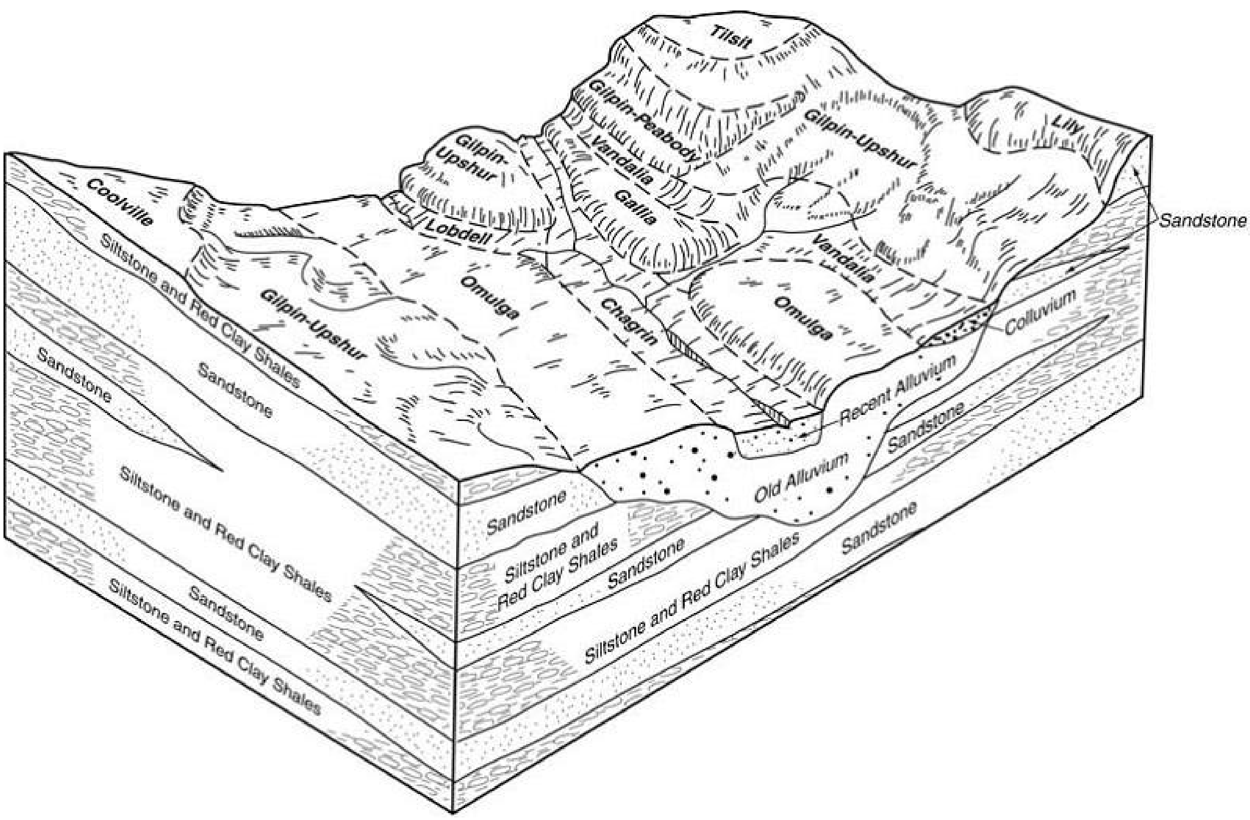

Figure 3.4-4. Diagram Showing Soils Typical of the Mountaineer CCS II Project Area

Source: USDA, 2008

Table 3.4-1. Soil Properties

Soil Unit Symbol	Soil Unit Description	Soil Unit Composition	Shrink-Swell Potential	Hazard of Erosion	Surface Runoff	Depth to Bedrock	HEL or PHEL	Prime Farmland or Farmland of Statewide Importance
CcC	**Cedarbrook channery loam, 3 to 15 percent slopes, very stony** soil units consist of very deep, well drained soils that formed in overburden form surface mining operations on gently sloping and strongly sloping, reclaimed and unreclaimed strip mines.	90 percent Cedarcreek soil;10 percent inclusions	Low	Moderate or severe	Low	> 5 feet	PHEL	No
CdA	**Chagrin loam, 0 to 3 percent slopes, occasionally flooded** soil units consist of very deep, well drained soils that formed in loamy alluvial sediments in flood plains in the middle or lower reaches of named streams that flow into the Ohio River. While the Chagrin loam soil units are generally well drained, they include areas of depressions and old oxbows that contain Melvin hydric soils. Hydric soils may be found in the soil unit.	75 percent Chagrin loam; 25 percent inclusions	Low	Slight	Low	> 6 feet	No	Prime Farmland
CsB	**Coolville and Tilsit soils, 3 to 8 percent slopes** soil units are formed in deep, moderately well drained soils that are located on gently sloping ridgetops. The Coolville series formed in red and gray shale, siltstone, and some sandstone. The Tilsit series formed in siltstone and fine grained sandstone.	Nearly all Coolville soil; nearly all Tilsit soil, or a combination of both	Coolville – moderate Tilsit - low	Moderate	Medium	40 to 60 inches	PHEL	Farmland of Statewide importance
GaC	**Gallia loam, 8 to 15 percent slopes** soil units consist of very deep, well-drained soils that formed in loamy alluvium of Teays-age origin. They are positioned on strongly sloping, loamy terraces on high terraces along the Ohio River.	60 percent Gallia; 40 percent inclusions	Moderate	Severe	Medium	> 5 feet	HEL	Farmland of Statewide importance
GmF	**Gilpin-Peabody complex, 35 to 65 percent slopes, very stony** soil units are positioned on very steep, convex, dissected upland side slopes. The Gilpin soil series are moderately deep, well drained soils that formed in nearly horizontal interbedded siltstone, fine grained sandstone, and shale. The Peabody soil series are moderately deep, well drained soils positioned on side slopes and formed in interbedded siltstones, clay shales, and fine grained sandstone.	45 percent Gilpin; 20 percent Peabody; 35 percent inclusions	Gilpin – low Peabody-high	Very severe	Very high	20 to 40 inches	HEL	No

Table 3.4-1. Soil Properties

Soil Unit Symbol	Soil Unit Description	Soil Unit Composition	Shrink-Swell Potential	Hazard of Erosion	Surface Runoff	Depth to Bedrock	HEL or PHEL	Prime Farmland or Farmland of Statewide Importance
GoF	**Gilpin-Peabody-Rock outcrop complex, 35 to 65 percent slopes, very stony soil units are positioned on very steep, convex, dissected upland sideslopes.** The Gilpin soil series are moderately deep, well drained soils that formed in nearly horizontal interbedded siltstone, fine grained sandstone, and shale. The Peabody soil series are moderately deep, well drained soils positioned on side slopes and formed in interbedded siltstones, clay shales, and fine grained sandstone.	40 percent Gilpin soils; 20 percent Peabody soils; 10 percent Rock outcrop complex; 30 percent inclusions	Gilpin – low Peabody-high	Very severe	Very high	20 to 40 inches	HEL	No
GpC	**The Gilpin-Upshur complex, 8 to 15 percent slopes** soil units are positioned on strongly sloping, convex, and dissected upland ridgetops. The Gilpin soil series are moderately deep, well drained soils that formed in nearly horizontal interbedded siltstone, fine grained sandstone, and shale. Upshur soil series are deep or very deep, well drained soils that formed in clay shales interbedded with siltstone.	55 percent Gilpin soils; 25 percent Upshur soils; 20 percent inclusions.	Gilpin – low Upshur -high	Severe	Medium or high	Gilpin-20 to 40 inches Upshur- 40 to 60 inches	HEL	Farmland of Statewide Importance
GpD	**The Gilpin-Upshur complexes**, 15 to 25 percent slopes soil units are similar to GpC but are positioned on moderately steep, convex, dissected upland ridgetops and upper sideslopes.	55 percent Gilpin soils; 25 percent Upshur soils; 20 percent inclusions.	Gilpin – low Upshur –high	Severe	Medium or high	Gilpin – 20 to 40 inches Upshur – 40 to 60 inches	HEL	Farmland of Statewide Importance
GpE	**The Gilpin-Upshur complexes, 25 to 35 percent slopes** soil units are similar to GpC but positioned on steep, convex, and dissected upland side slopes.	55 percent Gilpin soils; 25 percent Upshur soils; 20 percent inclusions.	Gilpin – low Upshur -high	Very severe	Very rapid	Gilpin-20 to 40 inches Upshur- 40 to 60 inches	HEL	No
Ld	**Landfill** soil units consist of nearly level to strongly sloping areas that have been used for the disposal of waste and then covered with fill material.	95 percent landfills; 5 percent inclusions	Varies	Varies	Varies	Varies	Varies	No

Table 3.4-1. Soil Properties

Soil Unit Symbol	Soil Unit Description	Soil Unit Composition	Shrink-Swell Potential	Hazard of Erosion	Surface Runoff	Depth to Bedrock	HEL or PHEL	Prime Farmland or Farmland of Statewide Importance
LID	**Lily fine sandy loam, 15 to 25 percent slopes** soil units are moderately deep, well drained soils that formed in medium grained and fine grained sandstone parent materials located on steeply sloping ridgetops.	75 percent Lily; 25 percent inclusions.	Low	Severe	High	20 to 40 inches	HEL	Farmland of Statewide importance
LsA	**Lindside silt loam, 0 to 3 percent slopes, occasionally flooded** soil units are very deep, moderately well drained soils that formed in alluvial materials washed from the uplands into floodplains along larger tributaries. Hydric soils may be found in the soil unit.	85 percent Lindside; 15 percent inclusions.	Low	None or slight	Low	> 5 feet	PHEL	Prime Farmland
LvA	**Lobdell silt loam, 0 to 3 percent slopes, occasionally flooded** soil units are very deep, moderately well drained soils that formed in loamy alluvial sediments in floodplain areas.	85 percent Lobdell; 15 inclusions.	Low	None or slight	Low	> 5 feet	No	Prime Farmland
OmB	**Omulga silt loam, 3 to 8 percent slopes** soil units are very deep, moderately well drained soils that formed in loess and stratified river sediments on old, gently sloping river terraces along the Ohio River. Hydric soils may be found in the soil unit.	70 percent Omulga; 30 percent inclusions.	Low	Moderate	Medium	> 5 feet	PHEL	Farmland of Statewide importance
PgF	**Peabody-Gilpin complex, 35 to 65 percent slopes** soil units are positioned on very steep, convex, dissected upland side slopes. The Peabody soil series are moderately deep, well drained soils positioned on side slopes and formed in interbedded siltstones, clay shales, and fine grained sandstone. The Gilpin soil series are moderately deep, well drained soils that formed in nearly horizontal interbedded siltstone, fine grained sandstone, and shale.	45 percent Peabody; 35 percent Gilpin; 20 percent inclusions	Peabody – high Gilpin – low	Very severe	Very high	20 to 40 inches	HEL	No
SnA	**Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded** soil units are very deep, well drained soils formed in mixed gravelly or cobbly alluvium on narrow flood plains. Hydric soils may be found in the soil unit.	85 percent Sensabaugh; 15 percent inclusions.	Low	None or slight	Very low	> 5 feet	No	Prime Farmland

Table 3.4-1. Soil Properties

Soil Unit Symbol	Soil Unit Description	Soil Unit Composition	Shrink-Swell Potential	Hazard of Erosion	Surface Runoff	Depth to Bedrock	HEL or PHEL	Prime Farmland or Farmland of Statewide Importance
SrB	**Sensabaugh loam, 3 to 8 percent slopes, rarely flooded** soil units are very deep, well drained soils formed in mixed gravelly or cobbly alluvium on narrow floodplains.	75 percent Sensabaugh; 25 percent inclusions.	Low	Moderate	Low	> 5 feet	No	Prime Farmland
Ud	**Udorthents, smoothed-Urban land complex** soil units consist of areas that have been drastically disturbed by excavating, grading, or filling, or by a combination of these measures and of areas covered by asphalt, concrete, buildings, and other impervious materials. The Udorthents and Urban complex differs from the other soil units in the study area in that it is characterized by having previously been disturbed, which overrides any other soil properties that would otherwise be used for classification.	50 percent Udorthents; 30 percent Urban land; 20 percent inclusions.	Varies	Varies	Varies	Varies	Varies	No
UeB	**Upshur silt loam, 3 to 8 percent slopes** soil units are deep or very deep, well drained soils in clay shales interbedded with siltstone on gently sloping, convex upland ridgetops.	75 percent Upshur; 25 percent inclusions.	High	Moderate	Medium	40 to 60 inches	PHEL	Farmland of Statewide Importance
UeC	**Upshur silt loam, 8 to 15 percent slopes** soil units are deep or very deep, well drained soils in clay shales interbedded with siltstone on strongly sloping, convex upland ridgetops.	75 percent Upshur; 25 percent inclusions	High	Very severe	Very rapid	40 to 60 inches	HEL	Farmland of Statewide Importance
UgC	**Upshur-Gilpin complex, 8 to 15 percent slope** soil units are positioned on strongly sloping, convex, dissected upland ridgetops. Upshur silt loams are deep or very deep, well drained soils in clay shales interbedded with siltstone on strongly sloping, convex upland ridgetops. The Gilpin soil series are moderately deep, well drained soils that formed in nearly horizontal interbedded siltstone, fine grained sandstone, and shale.	65 percent Upshur; 20 percent Gilpin; 15 percent inclusions	Upshur –high Gilpin – low	Severe	Medium or high	Upshur – 40 to 60 inches Gilpin – 20 to 40 inches	HEL	Farmland of Statewide Importance

Table 3.4-1. Soil Properties

Soil Unit Symbol	Soil Unit Description	Soil Unit Composition	Shrink-Swell Potential	Hazard of Erosion	Surface Runoff	Depth to Bedrock	HEL or PHEL	Prime Farmland or Farmland of Statewide Importance
UgD	**Upshur-Gilpin complex, 15 to 25 percent slopes** soil units are similar to UgC but are positioned on steep, convex, dissected upland ridgetops, upper sideslopes, and narrow benches.	55 percent Upshur; 25 percent Gilpin; 20 percent inclusions.	Upshur –high Gilpin – low	Severe	High or very high	Upshur – 40 to 60 inches Gilpin – 20 to 40 inches	HEL	No
UgE	**Upshur-Gilpin complex, 25 to 35 percent slopes** soil units are similar to UgC but are positioned on steep, convex, dissected sideslopes.	50 percent Upshur; 25 percent Gilpin; 25 percent inclusions.	Upshur -high Gilpin – low	Very severe	Very high	Upshur – 40 to 60 inches Gilpin – 20 to 40 inches	HEL	No
VdD	**Vandalia silt loam, 15 to 25 percent slopes** soil units are very deep, well drained soils that formed in colluvium derived from the Gilpin, Upshur, and Peabody soils on steep, concave footslopes and along drainageways.	75 percent Vandalia; 25 percent inclusions.	High	Severe	High or very high	> 5 feet	HEL	Farmland of Statewide Importance
VdE	**Vandalia silt loam, 25 to 35 percent slopes** soil units are similar to VdD but are positioned on steeper slopes and have slightly more inclusions.	65 percent Vandalia; 35 percent inclusions.	High	Very severe	Very high	> 5 feet	HEL	No

HEL = highly erodible land; PHEL = potentially highly erodible land

3.4.2.1 CO_2 Capture Facility

Soils in the area identified for the CO_2 capture facility have been mapped as Ud (see Table 3.4-1). This soil unit consists of areas that have been drastically disturbed by excavating, grading, or filling, or by a combination of these measures and of areas covered by asphalt, concrete, buildings, and other impervious materials. Analysis of aerial photography shows that approximately half of the area proposed for the CO_2 capture facility is currently covered by structures or other impervious surfaces, while the other half appears to be graded and covered with maintained grass.

3.4.2.2 Pipeline Corridors

North Corridor

Approximately half (48 percent) of the soil units along the North Corridor ROW are mapped as various Gilpin-Upshur complexes (GpC, GpD, GpE). These complexes are mostly mapped south of Broad Run Road. GmF soil units (8 percent) have been mapped within the ROW in small areas surrounding Borrow Area 8. GpC, GpD, GpE, and GmF are soil units with relatively severe hazards of erosion, high surface water runoff, and shallow depth to bedrock. A large portion of the North Corridor has been mapped as Ud soil units (21 percent), indicating these areas are already developed. In addition, CdA soil units (15 percent) have been mapped in the Little Broad Run floodplain west of a man-made cooling pool associated with the existing Mountaineer Plant. ThC soil units (7 percent) have been mapped just north of Broad Run Road. Table 3.4-2 shows the distribution (percentage) of soil unit occurrence within the North Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-2. North Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CdA	Chagrin loam, 0 to 3 percent slopes, occasionally flooded	PF		15
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	8
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	14
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	21
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	13
M-W	Miscellaneous water	N/A	N/A	1
ThC	Tarhollow silt loam, 8 to 15 percent slopes			7
Ud	Udorthents, smoothed-urban land complex			21

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

South Corridor

The South Corridor ROW has a variety of soil units; however, it is in general dominated by the Gilpin-Upshur complexes (GpC, GpD, GpE) (40 percent), GmF soil units (21 percent), PgF soil units (2 percent), UeC soil units (3 percent), and various Upshur-Gilpin complexes (UgC, UgD, UgE) (9 percent). These are soil units with relatively severe hazards of erosion, high surface water runoff, and shallow depth to bedrock. They are intersected by the floodplain soil units OmB (15 percent) and SnA (5 percent). CsB soil units (3 percent), VdD soil units (2 percent), and VdE soil units (2 percent) are also mapped along the ROI in minor extent. Table 3.4-3 shows the distribution (percentage) of soil unit occurrence within the South Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-3. South Corridor Soils

Soil Unit		PF/FSI	HELor PHEL	Percent of Corridor
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	3
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	21
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	10
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	12
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	18
OmB	Omulga silt loam, 3 to 8 percent slopes	FSI	HEL	15
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	2
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF	PHEL	5
UeC	Upshur silt loam, 8 to 15 percent slopes	FSI	HEL	3
UgC	Upshur-Gilpin complex, 8 to 15 percent slopes	FSI		3
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	3
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	1
VdD	Vandalia silt loam, 15 to 25 percent slopes		HEL	2
VdE	Vandalia silt loam, 25 to 35 percent slopes		HEL	2

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Blessing Road Corridor

Gilpin-Upshur complexes (GpC, GpD) (48 percent) make up nearly half of the soils mapped along the Blessing Road Corridor ROW. GmF soil units (18 percent) are located close to the Blessing Road intersection and again at the Eastern Sporn intersection. SnA soil units (31 percent) have been mapped along the western portion of the Blessing Road Corridor ROW at the connection to the South Corridor. All the soil units, except for SnA, are soil units with relatively severe hazards of erosion, high surface water runoff, and shallow depth to bedrock. Table 3.4-4 shows the distribution (percentage) of soil unit occurrence within the Blessing Road Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-4. Blessing Road Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	18
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	14
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	35
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF		32
VdD	Vandalia silt loam, 15 to 25 percent slopes		HEL	1

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

East Corridor

Approximately two-thirds of the soils mapped in the East Corridor belong to steeply sloping soil units GmF (24 percent), Gilpin-Upshur complexes (GpC, GpD, GpE) (37 percent), UgD3 (4 percent), and VdD (2 percent). The rest of the soil units are flat to gently sloping floodplain soils (SnA, SnB) (13 percent), river terrace soils (OmB) (16 percent), or ridgetop soils (CsB) (4 percent). Table 3.4-5 shows the distribution (percentage) of soil unit occurrence within the East Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-5. East Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	4
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	24
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	25
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	10
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	2
OmB	Omulga silt loam, 3 to 8 percent slopes	FSI	PHEL	16
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF		8
SnB	Sensabaugh loam, 3 to 8 percent slopes, rarely flooded	PF		5
UgD3	Upshur-Gilpin complex, 15 to 25 percent slopes, severely eroded		HEL	4
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	2

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Eastern Sporn Corridor

Over one-third of the soils in the Eastern Sporn Corridor ROW belongs to the PgF units (37 percent), approximately one-fourth belongs to Upshur-Gilpin complexes (UgD, UgE) (28 percent) while GpE units accounts for 5 percent, and GmF soil units accounts for 14 percent. This totals 84 percent of soil units that are very steep, have high erosion hazards, and often shallow depth to bedrock. VdD (2 percent) and UeC soil units (2 percent) have also been mapped in minor extent. The steep soils are intersected by the floodplain soil units CdB (11 percent). Table 3.4-6 shows the distribution (percentage) of soil unit occurrence within the Eastern Sporn Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-6. Eastern Sporn Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	11
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	14
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	5
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	37
UeB	Upshur silt loam, 3 to 8 percent slopes	FSI	PHEL	1
UeC	Upshur silt loam, 8 to 15 percent slopes	FSI	HEL	2
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	22
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	6
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	2

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Jordan West Corridor

The majority of the soils (73 percent) in the Jordan West Corridor belong to either PgF or UgE. Both soils units contains soils with steep slopes, very severe hazards of erosion, very high surface water runoff, and relatively shallow depth to bedrock. Other similar soil units, but with less slope and deeper soil profiles include GpC and GpD (2 percent), UeC (6 percent), UgD (8 percent), and VdE (2 percent). This generally strongly sloping landscape is intersected by Claylick Run to the north and its associated floodplain soil units CdA (2 percent) and Tombleson Run to the south and associated floodplain soil units SnA (3 percent). Table 3.4-7 shows the distribution (percentage) of soil unit occurrence within the Jordan West Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-7. Jordan West Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CdA	Chagrin loam, 0 to 3 percent slopes, occasionally flooded	PF		3
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	3
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	1
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	1
LlD	Lily fine sandy loam, 15 to 25 percent slopes	FSI	HEL	1
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	39
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF		3
UeC	Upshur silt loam, 8 to 15 percent slopes	PF		6
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	8
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	34
VdE	Vandalia silt loam, 25 to 35 percent slopes		HEL	1

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Jordan East Corridor

The soils in the Jordan East Corridor are in general very similar to those in the Jordan West Corridor. Table 3.4-8 shows the distribution (percentage) of soil unit occurrence within the Jordan East Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-8. Jordan East Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CdA	Chagrin loam, 0 to 3 percent slopes, occasionally flooded	PF		3
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	3
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	2
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	1
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	36
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF		4
UeC	Upshur silt loam, 8 to 15 percent slopes	FSI	HEL	2
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	17
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	26
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	2
VdE	Vandalia silt loam, 25 to 35 percent slopes		HEL	4

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Western Sporn Corridor

The Gilpin-Upshur complexes (GpC, GpD, GpE) (39 percent) and (23 percent) take up approximately two-thirds of the soil units in the Western Sporn Corridor. Approximately half of these soil units have slopes in excess of 25 percent, and have severe hazards of erosion and potential for very high surface water erosion. Other sloping soils mapped in significant extent within the corridor includes the CsB soil units (10 percent), GaC soil units (4 percent), LlE soil units (9 percent), and VdD soil units (4 percent). Broad Run and its tributaries intersect the Western Sporn Corridor several times, and are surrounded by the LvA soil units (10 percent). Table 3.4-9 shows the distribution (percentage) of soil unit occurrence within the Western Sporn Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-9. Western Sporn Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	10
GaC	Gallia loam, 8 to 15 percent slopes	FSI	HEL	4
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	23
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	16
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	12
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	11
LlE	Lily fine sandy loam, 25 to 35 percent slopes		HEL	9
LvA	Lobdell silt loam, 0 to 3 percent slopes, occasionally flooded	PF		10
ThC	Tarhollow silt loam, 8 to 15 percent slopes	FSI	PHEL	1
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	4

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Foglesong Corridor

The Gilpin-Upshur complexes (GpC, GpD, and GpE) have been mapped throughout 77 percent of the Foglesong Corridor. Other sloping soil units include CsB (9 percent), GaC (4 percent), and VdD (9 percent). Minor portions of LvA (1 percent) soil units surrounding Tenmile Creek have also been mapped in the western area of the corridor. Table 3.4-10 shows the distribution (percentage) of soil unit occurrence within the Foglesong Corridor (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-10. Foglesong Corridor Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Corridor
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	9
GaC	Gallia loam, 8 to 15 percent slopes	FSI	HEL	4
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	12
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	48
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	17
LvA	Lobdell silt loam, 0 to 3 percent slopes, occasionally flooded	PF		1
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	9

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

3.4.2.3 Injection Well Sites

Mountaineer Plant

The soils at the Mountaineer Plant property have all been mapped as Ud. These soil units consist of areas that have been drastically disturbed by excavating, grading, or filling or by a combination of these measures and of areas covered by asphalt, concrete, buildings, and other impervious materials. None of the soils in the Mountaineer Plant injection well site have been mapped as HEL, PHEL, PF, or FSI.

Borrow Area

The soils in the Borrow Area are mapped primarily as GpD soil units (72 percent). The rest of the property is mapped as GmF soil units (27 percent). Less than 1 percent has been mapped as Ld. The Injection Well Site, BA-1, is located within the GpD soil unit. Table 3.4-11 shows the distribution (percentage) of soil unit occurrence within the Borrow Area (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units). However, STP investigations done as a part of the Phase I Archeological Survey conducted in the summer of 2010 (see Appendix H) found that most of the soils in the Borrow Area have been previously disturbed, and do not reflect what is shown in Table 3.4-11. According to the descriptions of the STP investigations, these soils would probably more correctly fit into the Ud (urban land) or Ld (landfills) soil unit descriptions.

Table 3.4-11. Borrow Area Property Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Property
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	27
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	72
Ld	Landfills		PHEL	1

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Eastern Sporn Tract

Most of the Eastern Sporn Tract has been mapped as GmF soil units (27 percent), GpC, GpD, or GpE soil units (36 percent), PgF soil units (9 percent), UeC soil units (6 percent), or Upshur-Gilpin complexes (UgD, UgE). Table 3.4-12 shows the distribution (percentage) of soil unit occurrence within the Eastern Sporn Tract (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil unit).

Jordan Tract

The three dominant soil unit types on the Jordan Tract are the GmF (30 percent), UeC (21 percent), and UgE (31 percent). PgF soil units (8 percent) have also been mapped to a significant extent. Table 3.4-13 shows the distribution (percentage) of soil unit occurrence within the Jordan property (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Western Sporn Tract

Almost half of the Western Sporn Tract has been mapped as GmF soil units (27 percent) or GpD and GpE (20 percent). Other sloping soil units on the property include CcC (10 percent) and VdD (12 percent). The property is dissected by a large unit of floodplain soil, LvA (26 percent). This floodplain is associated with Tenmile Creek. A smaller unit of floodplain soils is located along the northwest boundary. This is the LsA soil unit (3 percent). Table 3.4-14 shows the distribution (percentage) of soil unit occurrence within the Western Sporn Tract (refer to Table 3.4-1 regarding specific soil properties and descriptions of the soil units).

Table 3.4-12. Eastern Sporn Tract Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Property
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	3
GaC	Gallia loam, 8 to 15 percent slopes	FSI	HEL	1
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	27
GoF	Gilpin-Peabody-Rock outcrop complex, 35 to 65 percent slopes, very stony		HEL	3
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes	FSI	HEL	11
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	14
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	11
LlD	Lily fine sandy loam, 15 to 25 percent slopes	FSI	HEL	2
OmB	Omulga silt loam, 3 to 8 percent slopes	FSI	PHEL	1
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	9
SrB	Sensabaugh loam, 3 to 8 percent slopes, rarely flooded	PF		1
Ud	Udorthents, smoothed-urban land complex		PHEL	3
UeC	Upshur silt loam, 8 to 15 percent slopes	FSI	HEL	6
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	7
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	1

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Table 3.4-13. Jordan Tract Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Property
CsB	Coolville and Tilsit soils, 3 to 8 percent slopes	FSI	PHEL	3
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	30
PgF	Peabody-Gilpin complex, 35 to 65 percent slopes		HEL	8
SnA	Sensabaugh loam, 0 to 3 percent slopes, occasionally flooded	PF		3
UeC	Upshur silt loam, 8 to 15 percent slopes	FSI	HEL	21
UgD	Upshur-Gilpin complex, 15 to 25 percent slopes		HEL	4
UgE	Upshur-Gilpin complex, 25 to 35 percent slopes		HEL	31

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

Table 3.4-14. Western Sporn Tract Soils

Soil Unit		PF/FSI	HEL or PHEL	Percent of Property
CcC	Cedarcreek channery loam, 3 to 15 percent slopes, very stony		PHEL	10
GaC	Gallia loam, 8 to 15 percent slopes	FSI	HEL	2
GmF	Gilpin-Peabody complex, 35 to 65 percent slopes, very stony		HEL	27
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes	FSI	HEL	9
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes		HEL	11
LsA	Lindside silt loam, 0 to 3 percent slopes, occasionally flooded	PF	PHEL	3
LvA	Lobdell silt loam, 0 to 3 percent slopes, occasionally flooded	PF		26
VdD	Vandalia silt loam, 15 to 25 percent slopes	FSI	HEL	12

FSI = farmland of statewide importance; HEL = highly erodible land; PF = prime farmland; PHEL = potentially highly erodible land

3.4.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to physiography and soils in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.4.1.3.

3.4.3.1 Construction Impacts

Construction activities are described in detail under the CO_2 capture facility, the pipeline corridors, and the injection well sites sections below. Potential impacts to physiography and soils include grading, excavation, compaction, creation of impermeable surfaces, and erosion. The probability of soil erosion would be reduced by the implementation of BMPs during construction. AEP would develop and implement erosion control methods and stormwater management plans to ensure compliance with the state's enforcement of the CWA and applicable state standards (see Section 3.6, Surface Water).

CO_2 Capture Facility

Table 3.4-15 quantifies the potential impacts of construction disturbance to physiographic and soil resources resulting from the construction of the CO_2 capture facility. A total of 33 acres of soil would be temporarily impacted under the project. There are no prime farmland, farmland of statewide importance, HEL or PHEL mapped soils in the study area.

Under the project, the new CO_2 capture facility would be constructed on land that was previously graded or developed. Approximately half of the area is covered by existing buildings or other impermeable surfaces, while the other half is maintained as a mowed, grassy area. The soils that would be impacted have all been mapped as Ud, as described in Table 3.4-1.

Table 3.4-15. CO_2 Capture Facility Construction Disturbances to Soil Resources

Potential Property	Total Acres	Resource Impact Type				Resource Impact Rating
		Farmland Rating		Erodible Land Rating		
		Farmland of Statewide Importance (acres)	Prime Farmland (acres)	PHEL (acres)	HEL (acres)	
Mountaineer Plant	33	0	0	0	0	Neg to Min

Impact Rating Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial
HEL = highly erodible land; PHEL = potentially highly erodible land

Construction impacts would include direct impacts such as grading and excavation of soils, and creating impermeable surfaces on the majority of the area. However, due to the extent of previously disturbed soils, none of the areas are rated as farmland of statewide importance, prime farmland, PHEL or HEL; thus, the overall adverse impacts are considered negligible to minor. The construction activities would also include removal of the grass cover and demolition of existing buildings thereby increasing soil exposure to wind and water, possibly resulting in short-term indirect impacts such as runoff and erosion during site preparation. Stormwater discharges are regulated by the WVDEP, under Section 402 of the CWA (permitting requirements) through the NPDES permit program. An NPDES construction stormwater general permit from the WVDEP would be required prior to the initiation of construction activities. Compliance with the stormwater general permit would reduce the erosion impacts to negligible. The following BMPs would likely be required under the terms of the NPDES permit (WVDEP, 2006b):

- Preservation of natural vegetation, where possible, to prevent soil erosion and sedimentation into adjacent waterbodies or wetlands
- Stabilization of temporary access roads, haul roads, parking areas, laydown areas, material storage, and other onsite vehicle transportation routes immediately after grading to reduce the

erosion and subsequent regrading of temporary and permanent roadbeds, work areas and parking areas rutted by construction traffic during wet weather

- Mechanically roughening of the soil surface to create horizontal depressions on the contour, or leaving slopes in a roughened condition by not fine-grading them. This would aid in the establishment of vegetative cover with seed, reducing runoff velocity, increasing infiltration, reducing erosion, and providing for sediment trapping.
- Application of straw, hay, or other suitable materials to the soil surface to prevent erosion (protects the soil surface from rain impact, reduces the velocity of overland flow, and fosters the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold)
- Temporary seeding and mulching, or matting to produce a quick ground cover to reduce erosion on exposed soils that may be redisturbed or permanently stabilized at a later date
- Permanent seeding to establish perennial vegetative cover on disturbed areas to reduce erosion and decrease sediment yield from disturbed areas and to permanently stabilize disturbed areas

Pipeline Corridors

Table 3.4-16 quantifies the potential impacts of construction disturbance to physiographic and soil resources resulting from the pipeline corridor construction. The soils mapped in the area of construction disturbance are described in Section 3.4.2.

Minor or moderate adverse effects would be expected from the project, depending on the route selected. The construction activities (further described below) would cause direct impacts such as excavating and grading, and indirect impacts such as erosion from exposing and disturbing the soils, and compaction from heavy machinery. Erosion and compaction of the soils in turn could cause reduced productivity of prime farmland soils or farmland of statewide importance.

Excavation and grading of soils along the potential pipeline corridors would be conducted to create a trench for the pipeline. Stormwater discharges are regulated by the WVDEP, under Section 402 of the CWA (permitting requirements) through the NPDES permit program. An NPDES construction stormwater general permit from the WVDEP would be required prior to the initiation of construction activities, and would include mandatory BMPs.

The following BMPs would likely be required under the terms of the NPDES permit (WVDEP, 2006b) to further reduce the direct impacts from excavation and grading (in addition to the BMPs for the CO_2 capture facility listed previously in this section):

- Preserve natural vegetation especially on critical areas such as steep slopes, areas adjacent to perennial and intermittent watercourses, and swales or wetlands to prevent soil erosion and sedimentation into adjacent waterbodies or wetlands.
- Use wattles/fiber rolls to reduce and disperse runoff velocity and capture sediment. Wattles/fiber rolls are erosion and sediment control barriers consisting of straw or other organic materials wrapped in biodegradable tubular plastic or similar encasing material.
- Remove topsoil and temporarily store onsite separately from other excavated material.
- Cover stored topsoil so that it would not erode.
- Return the majority of the excavated material to the excavated ditch.
- Replace the topsoil as the upper most soil layer following pipeline construction.
- Restore the site to its original grade.

Table 3.4-16. Pipeline Corridor Construction Disturbances to Soil Resources

Potential Injection Well Property	Pipeline Route Options	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
			Farmland Rating		Erodible Land Rating		
			Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	Plant Routing	NA	NA	NA	NA	NA	NA
Borrow Area	Borrow Area Route	32.6	13.0	6.0	11.1	15.0	Minor
Eastern Sporn Tract	Eastern Sporn Route 1	72.1	36.3	10.0	20.4	41.3	Minor
	Eastern Sporn Route 2	119.2	43.7	9.4	25.3	84.2	Moderate
	Eastern Sporn Route 3	73.9	38.1	7.7	17.1	48.7	Minor
	Eastern Sporn Route 4	125.0	48.2	11.2	22.5	91.0	Moderate
Jordan Tract	Jordan Route 1	134.3	49.3	11.5	23.3	100.4	Moderate
	Jordan Route 2	134.0	49.3	11.5	23.2	98.9	Moderate
	Jordan Route 3	140.1	51.4	12.9	19.6	107.2	Moderate
	Jordan Route 4	139.8	51.2	13.3	20.4	105.7	Moderate
Western Sporn Tract	Western Sporn Route	82.7	39.2	11.5	12.0	58.8	Minor

[a] Construction impacts refer to those which occur in the 120 feet construction ROW.
NA = not applicable.

Temporary access roads would also be constructed usually within the construction ROW to support heavy pipeline construction machinery and transport vehicles. However, these access roads would be limited and temporary, and the land would be returned to pre-construction conditions after the pipeline was installed.

Removing vegetation and grading or otherwise moving the soils along the construction ROW would temporarily increase soil exposure to wind and especially rainwater, resulting in increased potential for indirect impacts such as runoff and erosion during site preparation. However, implementation of the construction BMPs listed in this section would reduce the erosion impacts associated with the project. Overall adverse impacts would be minor to moderate, increasing in erosion potential and intensity within steeply sloping areas. As previously stated, in areas of steep slopes, the anticipated construction ROW would likely be increased up to approximately 144 feet wide. This increased ROW width would allow for additional BMPs to be incorporated into the construction of the pipeline occurring within steep slope areas to provide a more gentle grade and to minimize erosion and indirect effects such as sedimentation. Stormwater discharges are regulated by the WVDEP, under Section 402 of the CWA (permitting requirements) through the NPDES permit program. An NPDES construction stormwater general permit from the WVDEP would be required prior to the initiation of construction activities, and would include mandatory BMPs. Implementation of the following additional BMPs (WVUES, 2010) would further reduce the erosion impacts in areas of severe slopes and HEL:

- Avoidance of potential trouble areas, such as natural temporary drainage ways, unstable soils like high shrink-swell potential soils, highly erodible soils, etc.

- Avoidance of road construction on extremely steep slopes to prevent the potential for erosion
- Avoidance of construction close to streams and open waters to prevent the potential for sedimentation
- Temporary improvements (where construction access road crossings of stream cannot be avoided) at stream crossings (adhering to Section 404 permit requirements) to avoid or reduce sedimentation of the stream
- Construction of water-bars (when construction of access roads on steep slopes cannot be avoided) across roads at an angle to turn running water off the sloped bare soil of the road and onto the forest soil where the vegetation root mass and humus can more easily soak up or disperse the water flow
- Clearing as little vegetation as possible for construction, and replanting of vegetation as soon as possible in areas not permanently disturbed by construction

Construction of the pipeline would be conducted as a phased effort over time. Therefore, the impacted soil acreages presented in Table 3.4-16 would be disturbed at different times, resulting in reduced soil impacts compared to an entire-corridor instantaneous impact to soils. As construction is completed within a given pipeline segment, the site would be restored and stabilized.

Areas of prime farmland and farmland of statewide importance would also be indirectly impacted from the construction activities. While the soils within the construction ROW would be returned to production if farmed, they could be less productive due to increased compaction and some loss of soil from erosion causing minor to moderate adverse impact to soil resources depending on the extent of farmland rated soils within each option. However, the preservation of topsoil during construction and replacement after construction ceases would help buffer the impact of the construction disturbance. In the long term, soil porosity would increase and bulk density would decrease over time after the soil is returned to either production or covered with natural vegetation.

Injection Well Sites

Tables 3.4-17 through Table 3.4-19 quantify the potential impacts to physiographic and soil resources resulting from the construction of pipeline spur options (Table 3.4-17), injection wells (Table 3.4-18), and the access roads (Table 3.4-19). The soils mapped in the area of construction disturbance are described in Section 3.4.2.

Negligible or minor adverse effects would be expected related to each of the potential injection well sites, depending on the pipeline spur option. The construction activities would cause direct impacts such as displacement, disturbance and/or compaction of soils from excavating and grading, and indirect impacts such as erosion from exposing and disturbing the soils, and compaction from heavy machinery. Erosion and compaction of the soils in turn would cause reduced productivity of prime farmland or farmland of statewide importance. As shown in Table 3.4-17, potential impacts resulting from construction of the pipeline spurs would range from negligible to minor. BMPs that could be implemented to reduce impacts from the project would be similar to those previously described for pipeline corridors

Site plans for each injection well site have not yet been finalized; however, for this analysis it was assumed that 5 acres would be temporarily disturbed by construction at each injection well site. Direct impacts would include displacement, disturbance, and/or compaction of soils from grading of the injection well sites and excavation of soils. Potential indirect impacts include compaction of soils in the well area and soil erosion from exposure after vegetation has been removed from the site. Direct and indirect impacts could be reduced by the application of appropriate BMPs. Even though most of the potential injection well properties are sited on soil units classified as HEL, it is highly likely that the site itself is on an inclusion that is not classified HEL, since one of the siting criteria used to determine suitable well locations is level topography. HEL is rarely located on level land.

Table 3.4-17. Pipeline Spur Options to Injection Well Sites Construction Disturbances to Soil Resources

Potential Injection Well Property	Final Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
				Farmland Rating		Erodible Land Rating		
				Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	NA	NA	NA	NA	NA	NA	NA	NA
Borrow Area	North Segment B	Spur to BA-1	0.7	0.5			0.7	Negligible
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1	1.2	1.0			1.2	Negligible
		Spur to ES-2	4.5	3.4			4.5	Negligible
		Spur to ES-3	6.7	6.5			6.7	Minor
	Eastern Sporn Corridor	Spur to ES-1	7.5	5.7			7.5	Minor
		Spur to ES-2	6.9	4.9			6.9	Minor
		Spur to ES-3	2.1				2.1	Negligible
Jordan Tract	Jordan West Corridor	Spur to JT-1	7.8	7.0			5.1	Minor
	Jordan East Corridor	Spur to JT-1	7.8	7.0			5.1	Minor
Western Sporn Tract	Foglesong Corridor	Spur to WS-1	NA	NA	NA	NA	NA	NA

[a] Construction impacts refer to those that occur within the 120-feet construction ROW.

NA = not applicable; the spur would be located entirely within the 5-acre injection well site.

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the pipeline spur options construction ROW (i.e., 0 acres present).

Table 3.4-18. Injection Well Site Construction Disturbances to Soil Resources

Potential Injection Well Property	Injection Well Site Options	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
			Farmland Rating		Erodible Land Rating		
			Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	MT-1	5.0					Negligible
Borrow Area	BA-1	5.0	3.4			4.9	Minor
Eastern Sporn Tract	ES-1	5.0	3.5			5.0	Minor
	ES-2	5.0	4.7			5.0	Minor
	ES-3	5.0	2.9			5.0	Minor
Jordan Tract	JT-1	5.0	4.6			4.6	Minor
Western Sporn Tract	WS-1	5.0	4.0			4.0	Minor

[a] Construction impacts refer to those that occur in the construction staging areas (locations that would be re-vegetated following construction and are not required for operations).

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the injection well sites (i.e., 0 acres present).

Table 3.4-19. Access Road Construction Disturbances to Soil Resources

Potential Injection Well Property	Final Pipeline Segment Option	Injection Well Site Options	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
				Farmland Rating		Erodible Land Rating		
				Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	NA	MT-1	NA	NA	NA	NA	NA	NA
Borrow Area	North Segment B	BA-1	0.4			0.4		Negligible
Eastern Sporn Tract	Blessing Road Segment B	ES-1	0.2	0.1			0.2	Negligible
		ES-2	0.8	0.8			0.8	Negligible
		ES-3	0.2	0.2	0.1		0.8	Negligible
	Eastern Sporn Corridor	ES-1	0.2	0.1			0.2	Negligible
		ES-2	0.8	0.8			0.8	Negligible
		ES-3	0.2	0.2	0.1		0.8	Negligible
Jordan Tract	Jordan West Corridor	JT-1[b]						Negligible
	Jordan East Corridor	JT-1[b]						Negligible
Western Sporn Tract	Foglesong Corridor	WS-1	0.2	0.2	0.1		0.2	Negligible

[a] Construction impacts refer to those that occur in the temporary ROW (50 feet ROW).

[b] No new access road would be required for the JT-1 Injection Well Site as an existing road would be used to access the site.

NA = not applicable.

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the access road construction ROW (i.e., 0 acres present).

There are no soils classified as prime farmland on any of the injection well sites; however all the sites contain soils that are classified as farmland of statewide importance. Even though the construction impacts would be localized and temporary, soil disturbance and compaction on the injection well sites would reduce productivity of the soil, and it is unlikely that the land could successfully be used for crop production for a long period after construction activities have ceased. However, as shown in Table 3.4-18, since the injection well sites are all less than 5 acres, and the construction would be done as a phased effort across sites, the potential adverse construction impacts to soil resources would be considered minor.

Any necessary access roads to the injection well sites would have a construction disturbance width of 25 to 30 feet, including a 5-foot ditch on each side of the 12- to 15-foot permanent road. As shown in Table 3.4-19, impacts to soils classified as prime farmland, farmland of statewide importance, PHEL, or HEL are less than 1 acre for any access road option and would be considered negligible. Nonetheless, BMPs could be incorporated as appropriate.

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of geologic characterization work. AEP anticipates the need for one to three monitoring wells per injection well, or per co-located pair of injection wells. Potential impacts related to soils would be similar to those described for the construction of the injection wells.

3.4.3.2 Operational Impacts

CO_2 Capture Facility

Overall, negligible impacts would be expected from the operation of the CO_2 capture facility. Areas not covered by impermeable surfaces would be landscaped and maintained. Pathways would be constructed to discourage foot traffic on unpaved areas, thus protecting the remaining vegetation from disturbance and the soils from erosion.

Pipeline Corridors

Table 3.4-20 summarizes the operational impacts to soil resources in the permanent corridor ROWs. Overall only minor indirect impacts would be expected from operational impacts since the pipeline corridors would be reestablished with original vegetative cover, and returned to prior use. Some minor indirect impacts from a slightly higher likelihood of erosion of the previously disturbed soils would be expected. Moderate indirect impacts would also be expected from usage of the Eastern Sporn Route 2 option due to the high area of HEL included in the permanent ROW.

Table 3.4-20. Pipeline Operational Disturbances to Soil Resources

Potential Injection Well Property	Pipeline Route Options	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
			Farmland Rating		Erodible Land Rating		
			Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	Plant Routing	NA	NA	NA	NA	NA	NA
Borrow Area	Borrow Area Route	13.6	5.6	2.7	4.5	6.3	Negligible
Eastern Sporn Tract	Eastern Sporn Route 1	30.2	15.7	4.3	8.5	17.3	Minor
	Eastern Sporn Route 2	49.8	43.7	7.9	20.7	93.7	Moderate
	Eastern Sporn Route 3	30.9	16.5	3.3	7.2	20.3	Minor
	Eastern Sporn Route 4	52.3	20.6	4.8	9.4	38.1	Minor
Jordan Tract	Jordan Route 1	55.9	32.1	7.4	9.2	41.9	Minor
	Jordan Route 2	55.9	20.8	4.9	9.6	41.4	Minor
	Jordan Route 3	58.4	21.7	5.5	8.2	44.8	Minor
	Jordan Route 4	58.4	21.8	5.7	8.2	44.2	Minor
Western Sporn Tract	Western Sporn Route	34.5	16.3	4.9	5.0	24.5	Minor

[a] Operational impacts refer to those that occur in the 50 feet permanent ROW.
NA = not applicable

Even though soils that have been previously disturbed are slightly less stable than native, undisturbed soils, the permanent ROW would be revegetated with appropriate grass mixes chosen for their value in increasing soil stability and decreasing probability of soil erosion. The permanent ROW would be routinely inspected, ensuring that any areas showing potential erosion would be stabilized. Over time, soil quality would increase as soil organic matter and porosity increase due to native fauna and flora returning to the soil.

Injection Well Sites

Tables 3.4-21 through Table 3.4-23 quantify the potential impacts of operational disturbance to physiographic and soil resources resulting from the pipeline spur options (Table 3.4-21), injection wells (Table 3.4-22), and the access roads (Table 3.4-23).

Negligible indirect impacts would be expected from some of the pipeline spur options from a slightly higher likelihood of erosion of the previously disturbed soils, and a loss of potential productivity for soils not in agricultural use, but rated farmland of statewide importance. Types of impacts are similar to those described for pipeline corridors.

Impacts to soils in the permanent injection well sites would be considered negligible due to the small area of disturbance (0.5 acre). Impacts to soils in the permanent monitoring well sites would be similar to the impacts discussed for the injection well sites.

Negligible indirect impacts to soil resources would be expected from the access road ROW disturbance and include dust caused by vehicles using the access roads as well as increased erosion in the ditches from the runoff caused by impermeable road surfaces.

Table 3.4-21. Pipeline Spur Options to Injection Well Sites Operation Disturbances to Soil Resources

Potential Injection Well Property	Final Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Total Acres	Resource Impact Type (acres)[a]				Resource Impact Rating
				Farmland Rating		Erodible Land Rating		
				Farmland of Statewide Importance	Prime Farmland	Potentially Highly Erodible	Highly Erodible	
Mountaineer Plant	NA	NA	NA	NA	NA	NA	NA	NA
Borrow Area	North Segment B	Spur to BA-1	0.3	0.3			0.3	Negligible
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1	0.5	0.5			0.5	Negligible
		Spur to ES-2	1.9	1.4			1.9	Negligible
		Spur to ES-3	2.84	2.8			2.8	Negligible
	Eastern Sporn Corridor	Spur to ES-1	3.1	2.4			3.1	Negligible
		Spur to ES-2	2.9	2.1			2.9	Negligible
		Spur to ES-3	0.9				0.9	Negligible
Jordan Tract	Jordan West Corridor	Spur to JT-1	3.2	3.0		1.2	2.0	Negligible
	Jordan East Corridor	Spur to JT-1	3.2	3.0		1.2	2.0	Negligible
Western Sporn Tract	Foglesong Corridor	Spur to WS-1	NA	NA	NA	NA	NA	NA

[a] Operational impacts refer to those that occur in the 50 feet permanent ROW.

NA = not applicable; the spur would be located entirely within the 5-acre injection well site.

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the pipeline spur options permanent ROW (i.e., 0 acres present).

Table 3.4-22. Injection Well Site Operation Disturbances to Soil Resources

Potential Injection Well Property	Injection Well Site Options	Total Acres	Resource Impact Type				Resource Impact Rating[a]
			Farmland Rating		Erodible Land Rating		
			Farmland of Statewide Importance (acres)	Prime Farmland (acres)	PHEL (acres)	HEL (acres)	
Mountaineer Plant	MT-1	0.5					Negligible
Borrow Area	BA-1	0.5	0.4			0.5	Negligible
Eastern Sporn Tract	ES-1	0.5	0.5			0.5	Negligible
	ES-2	0.5	0.5			0.5	Negligible
	ES-3	0.5	0.3			0.5	Negligible
Jordan Tract	JT-1	0.5	0.5			0.5	Negligible
Western Sporn Tract	WS-1	0.5	0.5			0.5	Negligible

[a] Construction impacts refer to those that occur in the permanent 0.5 acre injection well site used for operations.

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the injection well sites (i.e., 0 acres present).

Table 3.4-23. Access Road Operation Disturbances to Soil Resources

Potential Injection Well Property	Final Pipeline Segment Option	Injection Well Site Options	Total Acres	Resource Impact Type				Resource Impact Rating[a]
				Farmland Rating		Erodible Land Rating		
				Farmland of Statewide Importance (acres)	Prime Farmland (acres)	Potentially Highly Erodible Land (acres)	Highly Erodible Land (acres)	
Mountaineer Plant	NA	MT-1	NA	NA	NA	NA	NA	NA
Borrow Area	North Segment B	BA-1	0.4			0.4		Negligible
Eastern Sporn Tract	Blessing Road Segment B	ES-1	0.2	0.1	0		0.2	Negligible
		ES-2	0.8	0.8	0		0.8	Negligible
		ES-3	0.2	0.2	0.1		0.8	Negligible
	Eastern Sporn Corridor	ES-1	0.2	0.1	0		0.2	Negligible
		ES-2	0.8	0.8	0		0.8	Negligible
		ES-3	0.2	0.2	0.1		0.8	Negligible
Jordan Tract	Jordan West Corridor[b]	JT-1						Negligible
	Jordan East Corridor[b]	JT-1						Negligible
Western Sporn Tract	Foglesong Corridor	WS-1	0.2	0.2	0.1	0	0.2	Negligible

[a] Operational impacts refer to those which occur within the permanent (15-foot) ROW as well as the up to 7 feet area on each side of the permanent ROW where ditches would be constructed.

[b] No new access road would be required for the JT-1 Injection Well Site as an existing road would be used to access the site.

NA = not applicable

Note: Gray-shaded cells in the table indicate that no farmland of statewide importance, prime farmland, potentially highly erodible soils or highly erodible soils exist within the permanent access road ROW (i.e., 0 acres present).

3.4.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to physiography and soils.

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3.5 GROUNDWATER

3.5.1 Introduction

This section identifies and describes the groundwater resources potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources.

3.5.1.1 Region of Influence

The ROI for groundwater resources includes the USDW and brine aquifers underlying the Mountaineer CCS II Project locations, including the Mountaineer Plant, potential CO_2 pipeline corridors and injection well sites. The ROI also includes the brine aquifer that may be used to obtain water for construction and operational support. The lateral extent of the ROI varies as outlined below, depending on the potential for impact and the characteristics of the groundwater resource. For the purposes of this analysis, the ROI for groundwater resources is defined as follows:

- The aquifers included in a circle with a radius of 3.5 miles from the center of each of the potential CO_2 injection well sites. This area would be most likely to be impacted by CO_2 migration from the injection zone. This distance is based on preliminary reservoir analyses, which suggest that after 20 years of injection, the CO_2 plume would have a lateral extent of approximately 2 miles in the Rose Run Formation, and approximately 3 miles in the Copper Ridge Formation.
- The shallow aquifers within the existing Mountaineer Plant footprint and within the construction corridors for the proposed pipelines and injection well sites. These areas could be affected by potential accidental spills that could occur during construction and operation.

3.5.1.2 Method of Analysis

The description of the affected environment for groundwater resources is based on reports and maps from the WVGES; water source data from the New Haven, West Virginia and Mason County water departments; data from the existing Mountaineer Plant PVF injection wells; the UIC permit application for the PVF injection wells; and results from the PVF facility injection reports. DOE determined potential impacts to groundwater resources based on anticipated process water requirements, chemical inventory, spill prevention and mitigation BMPs, and the results from CO_2 injection modeling.

3.5.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to groundwater based on whether the Mountaineer CCS II Project would directly or indirectly

- deplete groundwater supplies on a scale that would affect available capacity or quality of a groundwater source for use by existing water rights holders, interfere with groundwater recharge, or reduce the discharge rate to existing springs or seeps;
- conflict with established water rights, allocations, or regulations protecting groundwater for future beneficial uses;
- potentially contaminate USDWs through acidification of the aquifer due to migration of CO_2 or toxic metal dissolution and mobilization, displace brine due to CO_2 injection, or contaminate aquifers due to chemical spills, well drilling, well development (i.e., hydraulic fracturing), or well failures; or
- conflict with regional or local aquifer management plans or the goals of governmental water authorities.

3.5.2 Affected Environment

3.5.2.1 Regional Groundwater Availability

Groundwater in Mason County is primarily used as a source of water for industrial uses, public drinking water, and agriculture. Most of the potable groundwater in the county is located within alluvial deposits of river and stream valleys that are bounded by bedrock. Some sandstone units in the shallowest bedrock formations are occasionally used for potable water. Deeper, saline aquifers have been used for industrial uses (Wilmoth, 1966).

There are three main potable groundwater sources around the existing Mountaineer Plant: (1) the Ohio River Valley-fill aquifer, (2) Quaternary alluvium in stream valleys, and (3) sandstone units in the Pennsylvanian bedrock. The Ohio River Valley-fill aquifer is the most productive, with yields of up to 1,000 to 3,000 gallons per minute (gpm) (AEP, 2008). The Ohio and Kanawha Rivers influence the Mason County alluvial aquifers, as groundwater flow is directed to the river boundaries.

The Ohio River Valley-fill aquifer is bounded at its base by the Pennsylvanian bedrock (i.e., Monongahela Formation) and influenced by an ancient underground river channel that was created by glacial runoff. As the glaciers melted, 20 to 60 feet of sand and gravel sediment filled the valley, and was periodically capped by 15 to 40 feet of silt, clay, and thin sand deposits. This resulted in a semi-confined aquifer system which varies depending on whether the top of the water table is above or below the clay layer. The aquifer is unconfined if the water table falls underneath the silt-clay boundary (AEP, 2008). The alluvial groundwater and shallow bedrock aquifers are recharged by precipitation, as local groundwater flows from upland intake areas to the valleys. In areas with steep topography, groundwater is discharged in the valleys as springs and seeps.

The Ohio River Valley-fill aquifer is the most productive groundwater supply in Mason County, with 3.23 mgd of water available. This is compared to 0.05 mgd from the Kanawha River Valley aquifer or 1.00 mgd from sandstone units in the Pennsylvanian bedrock aquifer (Wilmoth, 1966). The Kanawha River Valley aquifer is another productive aquifer that supplies groundwater to other communities within Mason County. Pumping tests of the Ohio River Valley-fill aquifer showed that pumping 34 gpm for 24 hours is possible with no evidence of drawdown, and much higher rates of 1,000 to 3,000 gpm are possible, as groundwater flow is redirected from the Ohio River to the well (McGuinness and Meyer, 1965).

3.5.2.2 Groundwater Use

Mason County communities with public water supplies use groundwater as their source for drinking water. The municipal wells were drilled into alluvial aquifers, primarily the Ohio River Valley-fill aquifer. Other communities, including New Haven, Millwood, and the Ohio villages of Middleport, Racine, and Syracuse all have municipal water wells within the ROI. Households and farms not serviced by the municipal water supply use their own wells, which are drilled, driven, dug by hand, or occasionally fed by springs. There are no regional aquifer management plans for Mason County, West Virginia or Meigs County, Ohio.

The Mason County Public Service District provides the majority of potable water for the county. Mason County operates two Public Service District facilities, one of which (the Letart Facility) is located about 6 miles southeast of the Mountaineer Plant. As of 2010, the Letart Facility supplies 2,039 households by pumping an average of 190,000 gpd from 4 wells in the Ohio River Valley-fill aquifer. The wells have an average depth of 55 feet bgs (Grinstead, R., 2010). In contrast, the New Haven Water Facility (NHWF) services approximately 650 households with a 150,000 gpd withdrawal from 2 wells in New Haven that are drilled to about 80 feet bgs into the Ohio River Valley-fill aquifer (Oldaker, J., 2010). The other sanitary districts in the ROI have similar groundwater supply characteristics.

The Mountaineer Plant uses approximately 338,000 gallons of potable water per month from the NHWF. Groundwater wells located at the Mountaineer Plant are used for groundwater monitoring (see Section 3.5.2.4) and occasionally for fire protection. Cooling and process water for the Plant comes directly from the Ohio River via intake structures owned and operated by AEP.

Historically, saline wells in West Virginia and Mason County were used for industrial purposes. Deep saline wells have been drilled into the Pottsville Group of Pennsylvanian age and the Pocono Formation of Mississippian age. These bedrock formations are found at approximately 1,000 to 2,000 feet bgs. The untreated brine extracted from these wells was used by chemical industries and for creating industrial salt products (Wilmoth, 1966). Section 3.3, Geology, presents a discussion of the deep wells used for oil and gas production in the ROI.

WVDEP records list over 30 shallow waste injection wells located in the ROI southwest of the Mountaineer Plant. The closest wells are about 3,490 feet away. In 2007, Gatling, L.L.C., obtained a UIC permit for the waste injection wells associated with the Phillip Sporn mine. The wells extend to varying depths, with a maximum depth of 300 feet bgs (AEP, 2008). Waste streams from the mine operations (e.g., coal slurry) were injected into coal seams of abandoned mine voids in the undifferentiated Pennsylvanian bedrock. The facility is no longer in operation.

3.5.2.3 Groundwater Quality

Groundwater quality in the ROI is variable, with local quality dependent on the topography and composition of the host alluvial material or bedrock. The primary chemical constituents of Mason County groundwater are dissolved calcium, magnesium, sodium, bicarbonate, sulfate, and chloride. Past testing has shown that some wells contain water with iron and chloride concentrations above the federal secondary drinking water regulations (Wilmoth, 1966). However, the secondary drinking water regulations are non-enforceable and designed to minimize aesthetic impacts. The groundwater hardness in Mason County can vary from soft to very hard, but the overall water quality is within EPA standards.

There is evidence of connectivity between the shallow bedrock saline aquifers and the alluvial groundwater. Wilmoth (1966) described the process of local mixing between saline and fresh groundwater through natural zones of permeability or improperly sealed boreholes. Because the connection is localized and dependent on the bedrock topography, it is difficult to anticipate where the mixing would occur.

The Ohio River Valley-fill aquifer has little evidence of industrial contamination, with one exception. In 2004, the EPA fined DuPont for not reporting the health hazards of perfluorooctanoatic acid (C-8), a chemical used in manufacturing Teflon. EPA determined that the source of the chemical came from the DuPont plant in Washington, West Virginia, about 25 miles north of the Mountaineer Plant. C-8 was not identified at most of the testing sites within the ROI, which includes the NHWF and most of the wells associated with the Mason County Public Service District at Letart, the Village of Syracuse, and Pomeroy. However, trace amounts were found at wells near the Letart Landfill, and other municipal wells, specifically Mason County Public Service District Well No. 2 and the Village of Pomeroy Well No. 4 (WVDEP, 2003). Because the levels were below the toxicity screening level at the testing wells in Mason County, the task force suggested that the wells were influenced by recharge from the Ohio River, which carried trace amounts of the chemical originating from the DuPont wastewater discharges. Sampling at the Mason County testing wells was not continued because the C-8 levels were so low.

3.5.2.4 Underground Injection Wells

The underground injection of CO_2 is regulated under the EPA's UIC Program. The UIC Program works to protect USDWs from contamination by regulating the construction, operation, and abandonment of injection wells. Underground injection wells are primarily used to dispose of liquid wastes into the subsurface and have the potential to adversely affect USDWs. The EPA formally defines a USDW as an aquifer or part of an aquifer that

- supplies any public water system or contains a sufficient quantity of groundwater to supply a public water system and currently supplies drinking water for human consumption, or contains fewer than 10,000 milligrams per liter (mg/l) of TDS; and
- is not an exempted aquifer.

The main USDW for the region is the Ohio River Valley-fill alluvial aquifer, which is found approximately 85 feet bgs at the Mountaineer Plant. The lowermost USDW at the Mountaineer Plant is in the Pennsylvanian bedrock units that are less than 250 feet bgs (AEP, 2008). Other wells in the area, such as the Mason County Public Service District wells, withdraw drinking water from sandstone aquifers of the Pennsylvanian bedrock, but none are deeper than 250 feet. Below the Pennsylvanian bedrock, the salinity of the aquifers increases with depth. The TDS values commonly reach more than 100,000 mg/l at depths greater than 1,000 feet bgs (AEP, 2008; Wilmoth, 1966). Because deep bedrock aquifers are usually not connected vertically, there is no defined 10,000 mg/l boundary within the bedrock column.

EPA regulations define six classes (I-VI) of injection wells according to the type of waste that is disposed and where the waste is injected. All injection wells require authorization under general rules or specific permits. Many states, including West Virginia, have been granted primary enforcement responsibility (primacy) for the UIC Program. The EPA recently released the final regulations for a new class of injection wells, UIC Class VI, specifically for CO_2 geological sequestration. At this time, West Virginia has not been granted authority for permitting Class VI wells.

The existing injection wells at the PVF are operated under a UIC Class V well permit issued by the WVDEP. As part of the UIC permit requirements, AEP is required to monitor the groundwater quality around the PVF injection wells using monitoring wells that were installed in or before 2009. Under the UIC groundwater monitoring program, AEP collected baseline (prior to injection) and initial post-injection samples from the four shallow (less than 100 feet bgs) groundwater monitoring wells at the Mountaineer Plant. Ongoing groundwater monitoring continues in accordance with provisions in the UIC permit. Data from this monitoring program will be used to more conclusively evaluate groundwater parameters.

3.5.3 Direct and Indirect Impacts of the Proposed Action

Section 3.5.1.3 presents the impact criteria used in the DOE impact analysis. The following sections describe the potential for impacts on the criteria from implementing the Proposed Action.

3.5.3.1 Construction Impacts

CO_2 Capture Facility

Construction of the proposed CO_2 capture facility at the Mountaineer Plant would not be expected to directly or indirectly affect groundwater resources. The CO_2 capture facility would be built at the Mountaineer Plant property. The existing onsite groundwater wells would not be affected. There would be no onsite discharge to groundwater during the construction process. AEP would follow the requirements and procedures outlined in the SPCC Plan for all proposed construction activities. Stormwater runoff from construction would occur in compliance with the existing Mountaineer Plant NPDES Water Pollution Control Permit as well as the construction-specific NPDES permit. Petroleum-based materials and wastes generated during construction would be held in secondary containment to prevent spills and unintentional releases to groundwater. As such, no impacts to groundwater resources are anticipated from the construction of the CO_2 capture facility.

Pipeline Corridors

Potential impacts to groundwater resources from construction of the proposed pipeline corridors would be negligible. Small, incidental hazardous material or petroleum spills may occur during the pipeline construction process. However, such spills would be cleaned up immediately before they could reach the groundwater. The pipeline construction contractor(s) would manage any fuels and lubricants in accordance with the project-specific SPCC Plan, which would require immediate cleanup of incidental spills. Stormwater runoff from construction would occur in compliance with the construction-specific NPDES permit. The proposed 3-foot depth of the pipeline would not directly affect potable groundwater resources, which generally occur at a minimum depth of 25 feet bgs. As such, no impacts to groundwater resources from construction of the CO_2 pipelines are anticipated.

Injection Well Sites

The potential impacts from construction of the proposed injection well sites would be similar to the pipeline corridors; these impacts would be negligible. The injection wells would be constructed in accordance with the UIC permit and the well works permit to be issued for the project. Deep well-drilling BMPs and procedures used in the prior PVF injection well construction would be used to ensure that the drilling mud would not infiltrate shallow groundwater aquifers. These procedures would include the use of multiple casings made of carbon steel and using CO_2-resistant concrete to cement the long-string casing to just above the bottom of the intermediate casing (AEP, 2008). There is a potential that small, incidental spills may occur during the construction process. BMPs would be used to minimize the impact from any such occurrence. Stormwater runoff from construction would be managed in compliance with the construction-specific NPDES permit. If shallow groundwater is encountered during the injection well drilling, the water would be directed to lined mud pits and hauled offsite by a vendor for appropriate disposal (see Section 2.3.5.3).

Hydraulic fracturing or "well stimulation" may be required during the construction or future maintenance of the injection wells. During well stimulation, a fracturing fluid is pumped into the target injection formation at a very high pressure, such that the formation begins to crack (i.e., fracture). The PVF characterization study showed that the threshold fracture pressure for the Rose Run Formation is lower than the threshold fracture pressure for the formations within the confining zone. The threshold formation fracture pressure is the pressure above which fracturing would be expected to occur. In other words, the Rose Run Formation would fracture at a lower pressure than the surrounding formations. Therefore, well stimulation would not increase the potential for CO_2 leaks from the injection zone (AEP, 2008). The Copper Ridge Formation was not evaluated as a target formation in the initial strength tests, so the threshold fracture pressure would be evaluated during the characterization process. In the event that well stimulation would be needed, AEP would prepare and submit a detailed plan to the WVDEP for review and approval. In accordance with the new UIC Class VI rules, AEP would also notify the Director of the EPA prior to starting well stimulation activities (40 CFR 146.91 (d)(2)).

AEP would likely be required to install monitoring wells as part of their UIC permitting process. The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the geologic characterization work for the project. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. Construction of each monitoring well could disturb up to 5 acres. The impacts from construction of the monitoring wells would be similar to the injection wells, as described above.

3.5.3.2 Operational Impacts

CO_2 Capture Facility

The impacts to the groundwater resources from the operation of the proposed CO_2 capture facility would be minor. The only additional demands on groundwater resources would be to supply potable water for 38 additional employees at the Mountaineer Plant. The NHWF, which supplies potable water for the Mountaineer Plant, uses groundwater from the Ohio River Valley-fill aquifer. As described in Section 3.15, Utilities, the additional potable water needs would consist of 0.7 percent of the unused capacity of the NHWF. Therefore, the new potable water needs at the Plant would result in a slight increase in demand, and the impact would be minor.

During operation, there is a potential that small amounts of petroleum, oil, or lubricants could be spilled. The existing Plant SPCC Plan and NPDES permit would apply to the CO_2 capture facility, and serve to prevent and mitigate the impacts from any potential spill. The increase potential for spills related to the CO_2 capture facility operations would be negligible as compared to the existing plant operations.

Pipeline Corridors

Petroleum-based chemicals or fuels would not be stored along the proposed pipeline corridors unless maintenance activities were occurring. Although spills of petroleum-based chemicals (e.g., fuels and lubricants) could occur during maintenance, their impacts to groundwater would be negligible, provided that the appropriate spill response measures were implemented. All proposed maintenance activities would comply with AEP's SPCC Plan to ensure that the potential for spills is minimized, and that any inadvertent spills are remediated quickly and effectively without affecting local groundwater resources.

The groundwater depth in the area is at least 25 feet, well below the proposed pipeline. If CO_2 was to leak from the pipeline, it would escape as a gas and migrate to the atmosphere. It is not anticipated that any escaped CO_2 would ever reach groundwater, thus no impacts to groundwater would be expected from the operation of the CO_2 pipeline.

Injection Well Sites

It is expected that a minimum of four injection wells at two injection well properties would be required to inject 1.5 million metric tons of CO_2 per year. However, up to eight injection wells at four injection well sites could be used to meet the injection requirement. The ongoing geologic characterization study would be used to identify the final number and siting requirements for the injection wells. Each injection well site would likely contain a pair of wells, injecting into two formations within the injection zone. As described in Section 3.3, Geology, the likeliest formations are the Rose Run Formation, which is located approximately 7,800 feet bgs and the Copper Ridge Formation at approximately 8,200 feet bgs. The injection zone is capped by over 5,000 feet of the impermeable carbonate and shale sequences that make up the confinement zone. The injection and confinement zones are at a much greater depth than the groundwater aquifers used for public consumption, which are present up to 250 feet bgs. The multiple impermeable formations within the confining zone prevent the transmission of deep brine to the surface aquifers and would do the same for the injected CO_2.

CO_2 would be injected into the target formations at a temperature of 130 to 180°F and at a pressure of 3,400 to 7,000 psi (bottom hole pressure). CO_2 at this temperature and pressure is a supercritical fluid, so it would initially mix with the brine within the target formations. Because CO_2 is less dense than the surrounding brine, its buoyancy would cause it to move vertically upward to lower pressure zones until it is stopped by less permeable strata (e.g., the Beekmantown Formation within the injection zone). Over time, some of the injected CO_2 would dissolve into the brine in the target formation and move laterally (outward) from the injection well until pressures in the formation are equalized.

The potential impacts associated with CO_2 storage in geologic formations are largely associated with the possibility of migration upward through the confining zone or via the well itself. The potential for migration to occur would depend on the integrity of the formations within confining zone, the reliability of the well construction methods, and in the longer term, the degree to which the CO_2 eventually dissolves in the target formation brine or reacts with formation minerals to form carbonates. The following conditions could result in migration of injected CO_2 into shallower aquifers (e.g., aquifers that are used for local potable water supplies):

- CO_2 migrates into the upper aquifer via a transmissive fault[1], fracture, or localized permeable zone in the confining zone.

[1] Transmissive fault or fracture is a fault or fracture that has sufficient permeability and vertical extent to allow fluids to move between formations.

- CO_2 migrates "up dip" (along the structural gradient of the formation) and increases reservoir pressure and permeability of an existing fault.
- CO_2 migrates via improperly abandoned or unknown wells that penetrate the confining zone.

The injection well locations would ultimately be selected based on the results of the geologic characterization study and other available information. The geologic characterization study would identify and assess the target injection formations and the confinement zones. The Rose Run and the Copper Ridge Formations have been identified as the potential target formations for injection. These two formations are located within the injection zone, a sequence of formations with suitable characteristics to receive the CO_2. Based on currently available information, the Rose Run Formation and vuggy horizons within the Copper Ridge Formation are well suited as the target injection formations for several reasons:

- The overlying primary and secondary confining zones have a low porosity (1 to 5 percent) and permeability (less than 0.001 mD).
- Seismic studies demonstrate that the surrounding bedrock does not have any known transmissive faults.
- There is 7,000 feet of impermeable bedrock, including several thousand feet of low permeability layers, between the target injection formations and the deepest USDW.
- The target injection formations are nearly level, with a small dip to the southeast.
- The deepest known wells in the ROI are the existing PVF injection and monitoring wells at the Mountaineer Plant. These wells are designed to prevent vertical CO_2 migration. The next deepest wells in the ROI are drilled to 5,000 feet bgs, and do not penetrate the primary confining zone. This means that it is very unlikely that local wells could serve as a conduit between the injection locations and the upper groundwater aquifers.

Above the injection zone is the confining zone, which consists of several thick sequences of dense dolomite, limestone, and shale, all of which serve as barriers to prevent upward migration of CO_2. These layers have much higher fracture pressures than the Rose Run Formation (AEP, 2008). The geologic characterization study would determine the relative strength and threshold formation fracture pressure of the Copper Ridge Formation. One formation in the secondary confining zone, the Ordovician-age Martinsburg Shale, is over 1,000 feet thick. Section 3.3, Geology, describes the formations within the injection and confining zones in more detail.

During injection, CO_2 would travel along the areas of the greatest permeability (i.e., the path of least resistance) within the target injection formation until it reaches impermeable layers (i.e., the Beekmantown Formation in the injection zone). The CO_2 would dissolve within the target formation brine water and become trapped by capillary pressure in the pore spaces of the target formation over several hundred years (Fang et al, 2010). Based on these factors, migration of the CO_2 beyond the confining zone is unlikely. In addition, seismic surveys around the Mountaineer Plant provide evidence that the formations within the confining zone are laterally continuous, with no faults, forming an impenetrable barrier. Thus, it is unlikely that the CO_2 would bypass the confining zone and contaminate shallow groundwater resources (AEP, 2008).

To meet AEP's target CO_2 injection rate, four to eight injection wells would be constructed in pairs on two to four different properties. Preliminary estimates based on the proposed injection rates and data from the existing PVF injection wells suggests that injection for 20 years would result in a plume radius for each injection well of approximately 2 miles in the Rose Run Formation and 3 miles in the Copper Ridge Formation. Based on these preliminary results, the CO_2 migration is anticipated to occur laterally (outward), with minimal vertical (upward) migration within the target injection formations (AEP, 2008).

Increased pressure from the injected CO_2 would cause the brine within the injection zone to migrate laterally away from the injection well sites.

In addition to laterally displacing the brine, CO_2 would gradually dissolve into the brine. During dissolution, CO_2 can interact with the brine to create carbonic acid, a weak acid that could interact with the target formation. Heavy metals could be liberated with dissolution of the target formations. However, heavy metals would be trapped with the CO_2 within the target formations. The Rose Run Formation is primarily sandstone, which consists of silicon-based minerals that resist dissolution in acid. The Copper Ridge Formation is dolomite, which is more susceptible to the increased acidity; however the presence of carbonate materials within the formation results in the brine reaching equilibrium faster. Over time, the dissolved CO_2 could also precipitate as mineral deposits, which would permanently trap the CO_2.

The deepest USDW would be identified as part of the characterization studies that would be performed prior to the injection well siting. The earlier PVF characterization studies determined that the deepest USDW in the ROI is less than 250 feet bgs, within the undifferentiated Pennsylvanian bedrock (AEP, 2008). Although in Mason County there is no set depth where the TDS in groundwater is too high for classification as a USDW, local deep wells have found TDS concentrations of over 100,000 mg/l at 1,000 feet bgs. These levels are too high for classification as a USDW (<10,000 mg/l). The bedrock between 250 feet and 1,000 feet bgs did not yield enough water to evaluate the TDS levels. As such, it can reasonably be presumed that USDW depths do not exceed 250 feet within the ROI. As previously described, there are significant bedrock layers within the confining zone separating the relatively shallow USDW from the proposed target injection formations (i.e., over 7,000 feet) - a distance of over 1 vertical mile. This extensive bedrock sequence between the shallow USDW and the target injection formations would prevent CO_2 contamination of the USDW.

As part of the UIC permit application, AEP would outline the monitoring and verification procedures that would be used to verify that the injected CO_2 remains within the proposed target formations. AEP would likely implement the MVA program in accordance with the UIC permit (see Section 2.3.6). The data from the PVF monitoring wells would, in part, assist in the determination and application of the best, most appropriate monitoring options for the project. The monitoring and verification options associated with the project could include the following: chemical and pressure monitoring of the injection stream; corrosion monitoring of the well materials; annular pressure testing; temperature and tracer surveys; cross-well seismic monitoring; periodic wireline logging; collecting brine samples; and CO_2 migration modeling. The specific monitoring options to be implemented would be detailed in the final UIC permit to be issued by either the WVDEP or EPA.

In December 2010, the EPA released final regulations for a new UIC class specifically designed for CO_2 injection for the purpose of sequestration. These regulations went into effect on December 31, 2010; therefore, AEP would apply for a Class VI CO_2 sequestration UIC Permit that would cover all of the CO_2 injection wells. If West Virginia applies for primacy and the EPA approves their Class VI UIC program, the WVDEP would issue the permit for the injection wells. Otherwise, the EPA would issue the permit under the federal UIC Class VI permit program.

In addition, AEP would likely be required under the permit acceptance to install monitoring wells as part of their UIC and well work permitting process. AEP anticipates that one to three deep groundwater monitoring wells would be required to conduct monitoring in support of the UIC permit. The monitoring wells would likely be located within 1,500 to 3,000 feet from each injection well. Additional shallow monitoring wells may also be required to support USDW monitoring. The UIC permit would dictate the final number and siting requirements for the monitoring wells. Each monitoring well would be expected to require 0.5 acre during operations. Impacts from the operation of the monitoring wells would be similar to those discussed for the injection wells.

3.5.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to groundwater resources.

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3.6 SURFACE WATER

3.6.1 Introduction

This section identifies and describes the surface waters potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources.

3.6.1.1 Region of Influence

The ROI for surface water resources includes the Mountaineer Plant property, potential pipeline corridors, and potential injection well sites. The ROI also includes surface waters within the Middle Ohio South watershed that would be crossed by pipeline corridors or would potentially be influenced by construction or operation of the project.

3.6.1.2 Method of Analysis

DOE reviewed the project to determine which construction and operational activities have the potential to directly or indirectly affect surface waters. DOE conducted field surveys of the pipeline corridors and injection well sites in the summer of 2010 to identify and delineate surface waters and wetlands (see Appendix E, Wetland Survey Report). DOE used the data obtained from the field studies along with data obtained from reference documents and GIS-based mapping applications to aid in determining potential impacts to surface waters.

3.6.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to surface water based on whether the Mountaineer CCS II Project would directly or indirectly

- alter potential stormwater discharges, which could adversely affect drainage patterns, flooding, erosion, and sedimentation;
- alter potential infiltration rates, which could affect (substantially increase or decrease) the volume of surface water that flows downstream;
- conflict with applicable stormwater management plans or ordinances;
- violate any federal, state, or regional water quality standards or discharge limitations; or
- change the quality or availability of surface water for current or future uses.

3.6.2 Affected Environment

Surface water systems are typically defined in terms of watersheds (also called basins). A watershed is a land area bounded by topography that drains water to a common destination. Watersheds vary in size; every waterway (stream, tributary, and river) has an associated watershed and smaller watersheds combine to form larger watersheds. The project is located within the Ohio River Basin, which encompasses portions of 14 states with an area of more than 200,000 square miles, and over 5 percent of the total United States land mass (Storm Center Communications, 2010). On a more local scale, the proposed CO_2 capture facility, pipeline corridors, and injection well sites are located within the Middle Ohio South watershed (Hydrologic Unit Code 05030202) (WVDEP, 2010c). The Middle Ohio South watershed includes 1,403 square miles within the states of Ohio and West Virginia, with a perimeter of 227 miles. Figure 3.6-1 presents the major surface water features in the vicinity of the project, including the watershed boundary between the Middle Ohio South watershed and the watershed to the south of the project area (the Lower Kanawha watershed). Major surface waters within the watershed drained on the Ohio side include the Little Hocking River, Shade River, Leading Creek, Kyger Creek; and on the West

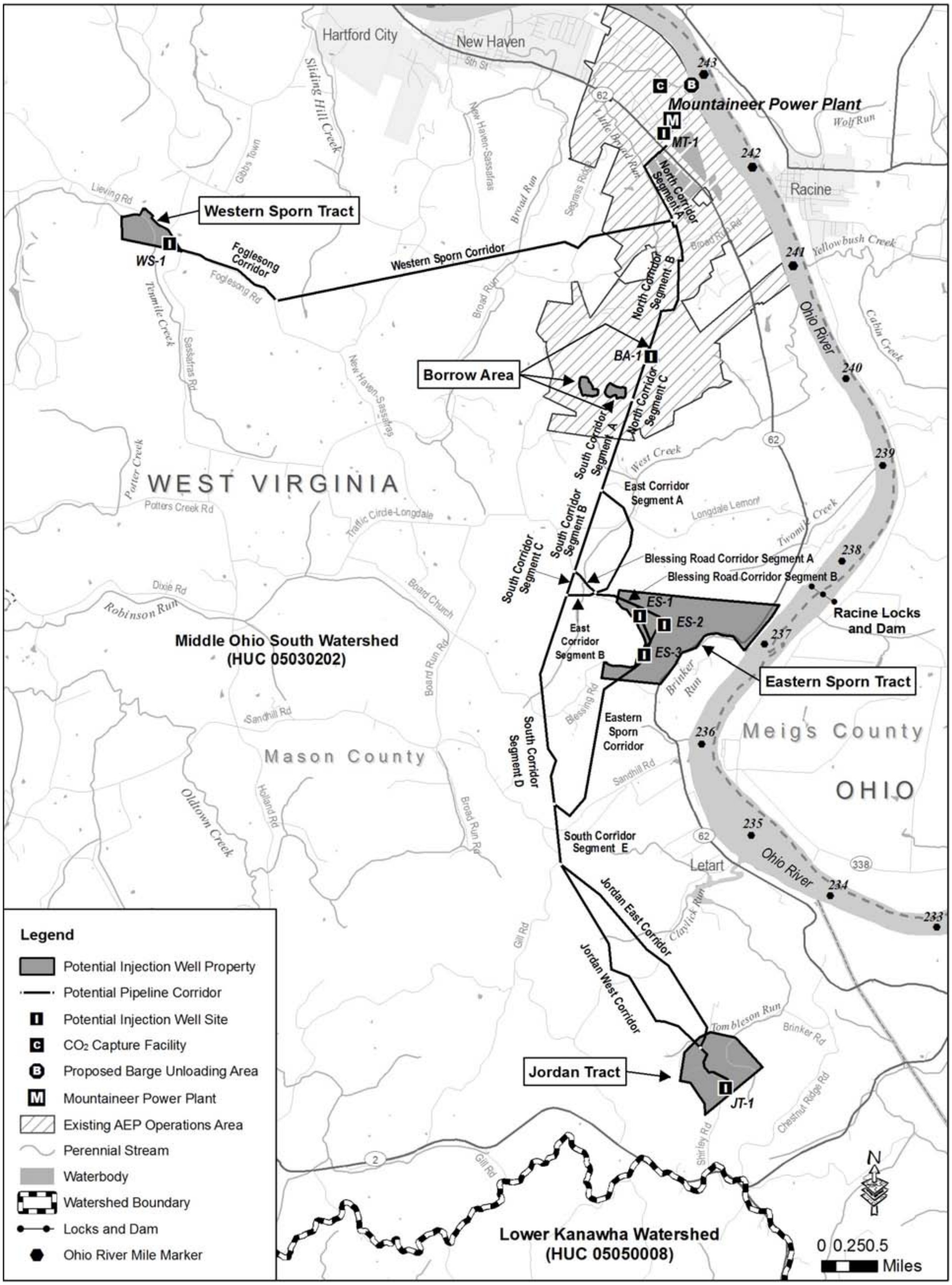

Figure 3.6-1. Surface Water Features in Vicinity of the Project

Virginia side includes the Little Kanawha River, Sandy Creek, Lee Creek, Pond Creek, Mill Creek, and Old Town Creek (Babendreier, 2000). The Ohio and West Virginia sides of the watershed are divided by the Ohio River. The drainage area includes all those Ohio River tributary watersheds within West Virginia downstream of Fish Creek and upstream of the Kanawha River, excluding the Little Kanawha River. This watershed is typified by moderate to low-gradient streams. The primary use of freshwater in the Middle Ohio South watershed is for fossil-fuel thermoelectric/hydroelectric power generation at four facilities. Total withdrawals for these operations (e.g. presumably Ohio River surface water) are 2,239 mgd, producing approximately. 34,000-gigawatt hours per year of electricity production. There are 111 WWTPs in the watershed, 30 of which are public plants. The public treatment facilities return 16.2 mgd of treated water back to the Ohio River (Babendreier, 2000).

The EPA and WVDEP regulate water quality under the SDWA and the CWA. Section 303(d) of the CWA requires states to identify and develop a list of impaired waterbodies. Impaired waterbodies are considered too polluted or otherwise degraded to meet the water quality standards or designated uses set by the State. Section 305(b) of the CWA requires states to assess and report the quality of their waterbodies. The WVDEP monitors the waters of the State as required by the CWA and reports the results in the West Virginia Integrated Water Quality Monitoring and Assessment Report, published biennially in even-numbered years. This report includes the 303(d) impaired streams listing, streams with total maximum daily loads (TMDLs), and 305(b) water assessment and designated use determinations. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. TMDLs are based on analyses that include pollution source identification and development of strategies for contaminant source reduction or elimination.

The 2008 West Virginia Integrated Water Quality Monitoring and Assessment Report (WVDEP, 2009c) was reviewed to identify impaired streams within the ROI. Table 3.6-1 displays the impaired surface waterbodies within the ROI, the impaired size, reach description (i.e. the portion of the waterbody impaired), the criteria effected, and their respective source of impairment. The impaired stream segments within the ROI include the Ohio River and Tenmile Creek. Some water quality issues impacting the Ohio River include nonpoint source pollution from urban runoff, agricultural activities, and abandoned mines.

Table 3.6-1. Impaired Water Resources within the ROI

Watershed	Waterbody Name	Impaired Size (miles)	Reach Description	Criteria Affected	Projected Start Year[a]	Source of Impairment
Middle Ohio South	Ohio River (Middle South)	65.8	MP 238 to MP 172.2	Dioxin, Bacteria, Iron	2012	Cause Unknown
	Ohio River (Middle South)	66.7	MP 265.7 to MP 203.2; MP 181.5 to MP 177.3	Bacteria	2012	Cause Unknown
	Ohio River (Middle South)	93.5	MP 265.7 to MP 172.2	Iron	2018	Cause Unknown
	Tenmile Creek	8.9	Entire Length	CNA-Biological	2011	Cause Unknown

Source: WVDEP, 2010d

[a] Projected start year of total maximum daily load (TMDL).

CNA = conditional not allowable; MP = milepost; ROI = region of influence

Studies have pinpointed elevated levels of bacteria from such sources as combined sewer overflows. Combined sewer overflows occur in older cities with "combined sewer systems," where the sewer system collects both stormwater runoff and sanitary sewage in the same pipe. During periods of heavy rainfall or snowmelt, volumes in combined sewer systems can exceed capacity, resulting in direct discharges to streams, rivers, lakes or estuaries. These overflows contain stormwater and untreated human and industrial waste and debris (Storm Center Communications, 2010).

In 2000 and 2002, EPA developed TMDLs for dioxin and PCBs, respectively for the Ohio River mainstem. The EPA TMDLs for dioxin included only sections of the Ohio River from the mouth of the Kanawha River downstream to the Kentucky state line. Additional sections of the river above the Kanawha River remain listed as impaired by dioxin. Currently, TMDLs have been or are being developed to address various impairments on many Ohio River tributary streams (WVDEP, 2009c). Table 3.6-1 displays the projected years TMDLs are expected for the impaired waters existing within the ROI.

The Ohio River begins at the confluence of the Allegheny and Monongahela rivers at the Point in Pittsburgh, Pennsylvania, and flows 981 miles west to join the Mississippi River at Cairo, Illinois (USACE, 2010). The Ohio River is the largest tributary, by volume, of the Mississippi River, and drains 189,422 square miles. The Ohio River is a naturally shallow river that was artificially deepened by a series of dams to enhance navigation. The natural depth of the river varies from approximately 3 feet to 40 feet. The dams raised the natural water level and have turned the river largely into a series of reservoirs, eliminating shallow stretches and allowing for commercial navigation (Discovery Media, 2010). The Racine locks and dam is the closest example of these dams and is located approximately 6 miles south southeast of the Mountaineer Plant (see Figure 3.6-1). The mean annual precipitation for this area of Mason County is 40 to 44 inches (USDA, 1997).

There are three gaging stations in Mason County along the Ohio River: one at Racine Dam, upstream of the existing Mountaineer Plant; one at Pomeroy, approximately 6 miles north of the Mountaineer Plant; and one at Point Pleasant, an additional 14 miles downstream from Pomeroy. Table 3.6-2 displays the gage station site number, location, period of record, and annual average high and low flow rates. Based on this data it appears as if the Ohio River experiences its highest flow between March and April and its lowest flow between September and October.

Table 3.6-2. Average Flow Rates of the Ohio River in Mason County

Site Number	Site Location	Period of Record	Monthly mean high flow (cfs)	Monthly mean low flow (cfs)
03159870	Racine Dam, West Virginia (between MP 237 and MP 238)	October 1979 to September 1980	April 136,000	September 28,100
03160000	Pomeroy, Ohio (between MP 248 and MP 252)	February 1936 to November 1969	March 124,000	September 15,300
13201500	Point Pleasant, West Virginia (between MP 263 and MP 266)	March 1940 to September 1977	March 156,000	October 21,400

Source: USGS, 2010d, USACE 2009, and USACE 2009a
cfs = cubic feet per second; MP = milepost

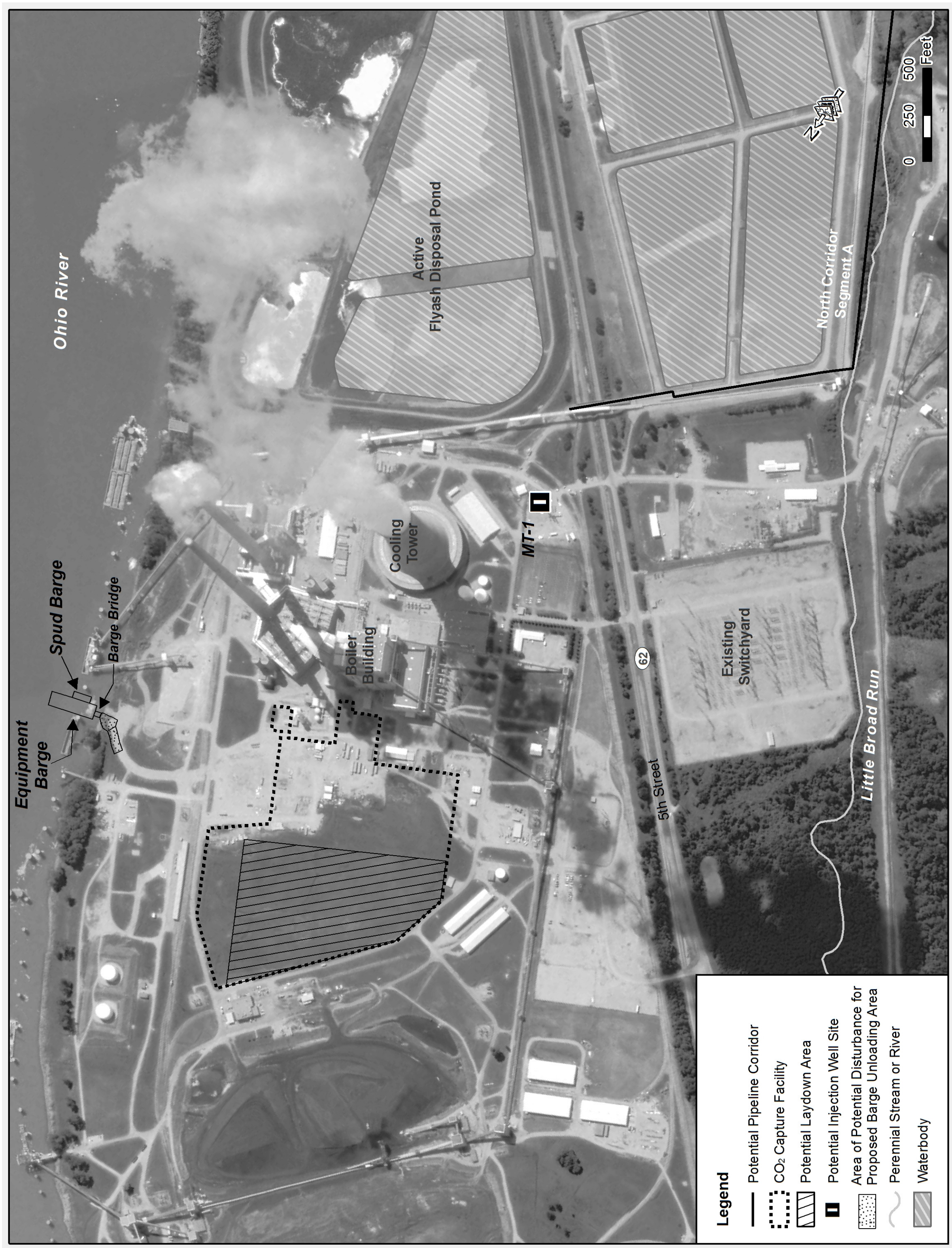

Figure 3.6-2. Surface Water Features near the Mountaineer Plant

3.6.2.1 CO_2 Capture Facility

The CO_2 capture facility would be located at the existing Mountaineer Plant. The Plant site is surrounded by industrial uses, such as structures associated with coal power generation, and relatively undeveloped land which is either forested or used for agricultural purposes. There are no surface water features within or immediately adjacent to the CO_2 capture facility; however, the Ohio River is located 1,000 feet to the east of the facility and Little Broad Run is located approximately 2,000 feet to the west of the facility. The land area proposed for the upgrades to the existing barge unloading area is located directly along the edge of the Ohio River on land ranging from approximately 545 feet amsl to 567 feet amsl (AEP, 2002). As per U.S. Army Corps of Engineers (USACE) Navigation Chart No. 160 the Mountaineer Plant is located between miles 244 and 242 on the Ohio River and the barge unloading area is located between miles 243 and 242 (USACE, 2009). The Ohio River ranges in width between approximately 1,000 and 1,200 feet in front of the Mountaineer Plant. Figure 3.6-2 depicts surface water features within the existing Mountaineer Plant boundary. The remaining surface water features onsite consist of man-made ponds used for wastewater treatment.

The Mountaineer Plant currently uses 18.74 mgd of process water (which includes cooling water) supplied through an existing river water loop located at mile 242.5 in the Ohio River (USACE, 2009). The existing river water intake system was originally authorized under a USACE Permit acquired in 1977. The river water intake system consists of three 48 inch pipes that extend 200 feet offshore into the Ohio River. The location, design, construction, and capacity of cooling water intake structures are regulated by the EPA under Section 316(b) of the CWA. The existing river water intake system at the Mountaineer Plant is below the Section 316(b) applicability thresholds, as less than 50 mgd is withdrawn and less than 25 percent of water withdrawn from the river is used for cooling purposes only (EPA, 2009d).

The WVDEP does not require a permit for the withdrawal of water from the river; however, users withdrawing more than 750,000 gallons per month must register with the WVDEP's Division of Water and Waste Management (DWWM) and report monthly uses of water (Stratton, 2010). The Mountaineer Plant is registered with the WVDEP and complies with all reporting requirements for the withdrawal. This withdrawal of water from the river represents 0.43 percent of the 7Q10 low flow rate for the river. The 7Q10 low flow rate is the lowest streamflow for 7 consecutive days that occurs on average once every 10 years. The WVDEP determined that the 7Q10 low flow rate at the Mountaineer Plant's existing withdrawal is approximately 4,400 mgd, as per a Water Resources Protection Act, Water Use Study conducted by the WVDEP (WVDEP, 2006a).

Water pollution control for point source discharges in West Virginia is primarily achieved through the NPDES permitting program administered by the DWWM. The state's NPDES stormwater management program is modeled on the federal NPDES program, which requires stormwater to be treated to the maximum extent practicable. NPDES permits include effluent limits and requirements for facility operation and maintenance, discharge monitoring, and routine reporting.

All industrial wastewater generated at the Mountaineer Plant is treated at the existing WWTP prior to discharge to the Ohio River (WVDEP, 2006c). The Mountaineer Plant generates approximately 17.3 mgd of wastewater from industrial processes. The Mountaineer Plant currently discharges treated wastewater to surface waters under NPDES Permit No. WV0048500, issued July 10, 2009 (EPA, 2010j). Since the issuance of this permit, no discharge exceedances have occurred (EPA, 2010k). Under the existing permit, the Mountaineer Plant discharges noncontact cooling water, process water, and stormwater runoff through multiple outlets located throughout the plant site to the Ohio River, Little Broad Run, and an unnamed tributary of the Ohio River (WVDEP, 2006a and WVDEP, 2009c).

Potable water used by the approximately 195 existing employees at the Mountaineer Plant is supplied by alluvial groundwater, which also serves New Haven and is distributed by the Town of New Haven Municipal Water and Sewer Department (for more information regarding groundwater, see Section 3.5, Groundwater).

3.6.2.2 Pipeline Corridors

Table 3.6-3 summarizes the surface water features that were surveyed by DOE within the pipeline corridors. No lakes or ponds are located within the pipeline corridors. Perennial surface waters within the corridors include Claylick Run, Little Broad Run, Broad Run, Tombleson Run, and West Creek. The pipeline corridors are typified by moderate to low-gradient streams, and many stream segments are slow-moving. None of these features are recognized as "high quality waters," "outstanding national resource waters," or "trout waters" (WVDEP, 2009c).

Table 3.6-3. Existing Surface Water Features within Potential Pipeline Corridor Segments

Potential Corridor	Potential Corridor Segment	Perennial Stream/Creek	Intermittent Stream	Ephemeral Stream	Pond/ Lake
North Corridor	North Corridor Segment A	1			
	North Corridor Segment B		2	4	
	North Corridor Segment C		1	4	
	Total	**1**	**3**	**8**	**0**
South Corridor	South Corridor Segment A	1	3		
	South Corridor Segment B	2	2		
	South Corridor Segment C		2		
	South Corridor Segment D	3	4	8	
	South Corridor Segment E		2	2	
	Total	**6**	**13**	**10**	**0**
Blessing Road Corridor	Blessing Road Corridor Segment A	1			
	Blessing Road Corridor Segment B		2	1	
	Total	**1**	**2**	**1**	**0**
East Corridor	East Corridor Segment A	1	3	2	
	East Corridor Segment B	1		1	
	Total	**2**	**3**	**3**	**0**
Eastern Sporn Corridor	Eastern Sporn Corridor	1	6	4	
Jordan West Corridor	Jordan West Corridor	4	5	3	
Jordan East Corridor	Jordan East Corridor	2	3	11	
Western Sporn Corridor	Western Sporn Corridor	2	8	14	
Foglesong Corridor	Foglesong Corridor		2	7	

Note*:* Shaded cells in the table indicate no surface water features are present within the pipeline segments.

The pipeline ROI also contains numerous intermittent and ephemeral stream channels. Intermittent streams carry water a considerable portion of the time as they are hydrologically connected to groundwater, but cease to flow occasionally or seasonally. Intermittent surface waters within the pipeline corridors include Mud Run, Brinker Run, and Sliding Hill Creek. Ephemeral streams only carry water for short periods of time following precipitation or snowmelt events and are not hydrologically connected to groundwater. Both intermittent and ephemeral streams with periodic flow typically provide minimal aquatic habitat (see Section 3.8, Biological Resources).

The only surface water feature listed as impaired within proximity to the pipeline corridors is the Ohio River. Although the cause of impairment is unknown as per the 303(d) list, nonpoint source pollution from urban runoff, agricultural activities, and abandoned mines, as discussed in Section 3.6.2 may contribute to the cause.

3.6.2.3 Injection Well Sites

AEP identified five AEP-owned properties for the location of injection and monitoring wells. At each property, AEP also identified potential sites for the wells (see Section 2.3.5.1). DOE conducted detailed field studies at all of the injection well properties with the exception of the Western Sporn Tract and the Mountaineer Plant. The detailed field survey at the Western Sporn Tract was limited to the 5-acre injection well site, while only a reconnaissance-level site walkover was conducted over the remainder of the property. The survey at the Western Sporn Tract was limited because it is the least preferred injection well property. Likewise, the detailed field survey at the Mountaineer Plant was limited to the 5-acre injection well site and the 33-acre CO_2 capture facility site.

Surface water features identified at the injection well properties are listed in Table 3.6-4. The streams surveyed by DOE are included in this table; however, the streams for the Western Sporn Tract were identified using a state GIS dataset. One perennial stream (Tenmile Creek) and one un-named intermittent stream currently exist within the Western Sporn Tract. The Mountaineer Plant injection well site does not contain any surface water features. A field review was conducted during the summer of 2010 at the three Borrow Area properties. The areas consist of graded and cleared land, with one ephemeral stream identified along the western edge of Borrow Area 8 (see Figure 2-10).

Table 3.6-4. Existing Surface Water Features within Potential Injection Well Properties

Potential Injection Well Property	Perennial Stream/Creek	Intermittent Stream	Ephemeral Stream	Pond/Lake
Mountaineer Plant[a,b]				
Borrow Area			1	
Eastern Sporn Tract	1	25	90	
Jordan Tract	1	9	37	
Western Sporn Tract[b]	1	1		

Source: USGS, 2010e
[a] The numbers only include natural features; they do not include man-made ponds or lakes currently used for other processes.
[b] The numbers only include features from the state GIS dataset, a field review was not conducted throughout the entire property.
Note*:* Shaded cells in the table indicate no surface water features are present within the property.

One perennial stream (Brinker Run) was identified within the Eastern Sporn Tract during the field review conducted in the summer of 2010. Figure 3.8-10 (Section 3.8, Biological Resources) shows the conditions of Brinker Run, which is relatively narrow, shallow, and well shaded within the Eastern Sporn Tract. Compared to streams observed within the pipeline corridors, the overall gradient provides higher flow velocities. Brinker Run's substrate is a rock bottom consisting of rubble. Twenty-five intermittent streams, many of which are tributaries to Brinker Run, including Two-Mile Creek and 90 ephemeral streams were also identified and mapped on the Eastern Sporn Tract.

One perennial stream (a tributary to Tombleson Run) was identified during the fieldwork conducted at the Jordan Tract. Figure 3.8-12 (Section 3.8, Biological Resources) displays the conditions of the tributary to

Tombleson Run: relatively narrow, shallow and well shaded. This perennial stream's substrate consists of cobble-gravel and is 7 feet in width and 2 feet in depth. The overall gradient provides higher flow velocities, compared to typical stream conditions within the pipeline corridors. The exposed root structures and slightly eroded streambanks along the tributary could indicate flash flows during heavy rainfall events and the potential for erosion/sedimentation into the stream. Nine intermittent streams, a majority of which are tributaries to Tombleson Run, and 37 ephemeral streams were also identified and mapped on the Jordan Tract.

Although surface waters have been identified on four of the potential injection well properties; there are no perennial streams within 500 feet of the preferred injection well sites at each of these properties. Table 3.6-5 lists the number of surface water features located within 500 feet of the preferred injection well sites. Aside from the ephemeral stream located within 500 feet of injection well site BA-1, all of the waters listed in Table 3.6-5 are located outside the boundaries of the potential injection well properties owned by AEP.

Table 3.6-5. Surface Water Features within 500 feet of the Potential Injection Well Sites

Potential Injection Well Property	Injection Well Site Option	Perennial Stream/Creek	Intermittent Stream	Ephemeral Stream	Pond/Lake
Mountaineer Plant	MT-1				
Borrow Area	BA-1		1	1	
Jordan Tract	JT-1		1	5	
Eastern Sporn Tract	ES-1		2	8	
	ES-2		2	3	
	ES-3		2	5	
Western Sporn Tract	WS-1		1		

Note: Shaded cells in the table indicate no surface water features are present within the property

3.6.3 Direct and Indirect Impacts of the Proposed Action

This section presents potential impacts to surface waters within the ROI for the project. DOE assessed the potential for impacts to surface water resources in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.6.1.3. Impacts are limited to those associated with water quality as well as the availability and use of surface water resources. Section 3.7, Wetlands and Floodplains, addresses impacts to surface water features and wetlands (specifically waters of the U.S.) in terms of how they would relate to potential USACE permitting. Therefore, Section 3.7 focuses on waters of the U.S. and the potential for impacts related to the placement of fill material, type conversions, and surface disturbances, which can ultimately affect the functions and values of these resources (e.g., flood flow attenuation).

3.6.3.1 Construction Impacts

Stormwater and wastewater discharges are regulated by the WVDEP under Sections 401 and 402 of the CWA (permitting requirements) through the NPDES. As there would be over 1 acre of disturbance, NPDES construction stormwater general permit(s) from the WVDEP would be required prior to the initiation of construction activities.

Initial construction activities would consist of clearing any existing vegetation and grading areas, which would result in the disturbance and exposure of soils. Exposed soils would be more susceptible to erosion from stormwater runoff, which could result in increased sedimentation and turbidity to receiving waterbodies, causing minor temporary adverse impacts to these waterbodies during construction. Additionally, potential surface water contamination from accidental spills of petroleum products could occur during construction activities causing potential impacts to receiving waterbodies. To minimize potential impacts to surface waters, the NPDES construction stormwater general permit requires the preparation of an SWPPP. This plan includes BMPs for erosion control and pollution prevention requirements, including BMPs for minimizing the potential for spills. After construction, all temporarily disturbed areas would be seeded with appropriate grass mixes to re-establish vegetative cover.

The following is a list of typical BMPs that could be implemented to further minimize the potential impacts to surface waters, where applicable:

- Use of temporary seeding and mulching, or matting to produce a quick ground cover to reduce erosion on exposed soils that may be redisturbed or permanently stabilized at a later date. This would minimize bare soil available for sediment transport during storm events.
- Stabilization of temporary access roads, haul roads, parking areas, laydown, material storage and other onsite vehicle transportation routes with stone immediately after grading. This practice is used to reduce the erosion and subsequent regrading of temporary and permanent roadbeds, work areas and parking areas rutted by construction traffic during wet weather.
- Maximize use of existing roads in planning site access.
- Keep construction materials, debris, construction chemicals, construction staging, fueling, etc. at a safe distance from surface waters to prevent unintentional contamination and keep spill kits on hand in case of spills to reduce response time.

With implementation of BMPs as a condition of the NPDES construction stormwater general permit, it is anticipated that impacts to surface waters during construction would be temporary and minor. Proper project design would ensure that drainage and runoff would occur without excessive erosion and increased turbidity. The use of silt fencing and other erosion control devices would prevent debris from entering nearby streams during construction. An SPCC plan would ensure that any potential spills would be cleaned up before they reach the surface water network.

CO_2 Capture Facility

As no surface waters exist within the CO_2 capture facility footprint or laydown area, no direct impacts to surface waters would occur. During storm events, it is possible that stormwater could erode exposed soils and wash the eroded soil into the Ohio River. Since the Ohio River is not listed as impaired due to sedimentation (see Table 3.6-1), any potential sediment that may make its way to the Ohio River would not add to an existing impairment and would be expected to result in minor impacts. With the implementation of BMPs to minimize opportunities for erosion and sedimentation, as a condition of the NPDES construction stormwater general permit, it is anticipated that indirect impacts to surface waters during construction would be temporary and minor.

Water required during construction (for dust suppression, washing tools and machinery, etc.) would be supplied by the Ohio River. Construction of the CO_2 capture facility is expected to require the use of approximately 2.5 million gallons of river water, to be supplied by the Mountaineer Plant's existing river water loop over a period of approximately 32 months starting in early 2013.

For hydrostatic testing (discussed in further detail under *Hydrostatic Testing*) and system startup, it is estimated a maximum of approximately 600,000 gallons of demineralized water would be needed. The demineralized water would be supplied through the Mountaineer Plant's existing demineralized water system, using the Ohio River as the water source. An estimated total of 3.1 million gallons of water from the Ohio River would be required for construction needs and startup over a 32-month construction period.

The additional withdrawal of 3.1 million gallons over a 32-month period would require the withdrawal of approximately 3,200 gpd, which would represent a 0.02 percent increase in the Mountaineer Plant's daily withdrawals from the Ohio River. As previously discussed in Section 3.6.2.1, the 7Q10 flow in the Ohio River at the Mountaineer Plant's existing withdrawal is approximately 4,400 mgd. A 0.02 percent increase in daily withdrawals would have a minor impact, and total daily withdrawals would continue to represent only 0.43 percent of the low flow.

As discussed in Section 2.3.3.3, AEP would upgrade the existing barge unloading area. Site preparation along the Ohio River bank would be required, including clearing of vegetation, grading of a portion of the river bank above the high-water line, and the placement of aggregate to stabilize and reinforce the river bank. Site preparation may result in temporary minor impacts including sedimentation. Since the Ohio River is not listed as impaired due to sedimentation (see Table 3.6-1), any potential sedimentation that may make its way to the Ohio River would not add to an existing impairment and would be expected to result in minor impacts. Stormwater impacts to surface waters during construction would be controlled and minimized through BMPs, proper design, and placement of runoff control features. The upgrades to the barge unloading area would not require work within the Ohio River except for the stabilization of the spud barge, which would require up to four temporary piles that could result in minor sedimentation impacts. Unloading of the barges would not require water usage. The footprint would involve approximately 0.28 acres of land disturbance, which would take place above the ordinary high-water mark of the Ohio River.

Upgrades to the existing barge unloading area would likely require the following permitting: a Section 10/404 permit from the USACE and Section 401 Water Quality Certification from the WVDEP. In addition, a Stream Activity Permit through the West Virginia Division of Natural Resources (WVDNR) and a Floodplain Development and Construction Permit from the Mason County Floodplain Administrator may be required (see Section 3.7, Wetlands and Floodplains). AEP would acquire all necessary permits and perform any required environmental studies prior to construction.

Pipeline Corridors

Construction of the pipeline would require temporary and direct disturbances to streams during construction. Impacts from in-stream disturbance would occur during the construction and restoration period at each potential pipeline crossing. The duration of impacts is expected to be temporary and would be minimized by the implementation of a restoration plan. Potential impacts could extend downstream dependent on flow and mixing conditions. Since the streams within the pipeline corridors are less than 15 feet in width and are not considered high quality waters or trout waters, it is unlikely that directional drilling would be considered as a construction method for stream crossings. Typical pipeline construction methods for crossing smaller surface water features would involve trenching methods.

Wet trenching is typically employed in streams with low velocity and/or where there are no water quality and aquatic habitat concerns immediately downstream. Wet trenching can dam and divert flow completely out of the channel, for example into a dry adjacent channel. Dry trenching is carried out during a period when the entire stream width is seasonally dry or is frozen to the bottom. It is assumed the wet trenching method would be used for the perennial and intermittent surface water crossings. The dry trenching method would likely be used for the ephemeral surface water crossings assuming they are void of water at the time of construction.

The probability of impacts occurring would increase the closer construction activities are located to existing surface waters, with the greatest probability for impact occurring when pipelines cross a surface water feature. Potential surface water impacts resulting from the construction of pipeline crossings using trenching methods could include stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, and removal of streambank vegetation. These would cause temporary and potentially moderate impacts during pipeline construction. Potential pipeline corridor attributes (e.g., ROW width, pipe size, etc.) are essentially the same for each route and, therefore, impacts would be dependent upon the number of crossings that are required.

For the purposes of this analysis, it was conservatively assumed that all surface waters existing within the 50-foot permanent (operational) pipeline ROW would be crossed by the pipeline. Furthermore, any streams located within the 80- to 120-foot temporary (construction) ROW, outside of the 50-foot permanent (operational) pipeline ROW, would be avoided to the maximum extent practicable. In the event that avoidance of surface waters within the temporary (construction) ROW is determined to be impracticable, potential temporary impacts to surface waters would be minimized and mitigated as necessary.

Table 3.6-6 displays surface water crossings assuming that all surface waters existing within the 50-foot permanent ROW would be crossed by the pipeline. The table also summarizes potential impacts of construction disturbance to surface waters for each of the alternative pipeline corridor routes (see Figure 2.7 for the location of the potential pipeline routes).

As summarized in Table 3.6-6, DOE assessed potential impacts to

- streambeds, including the potential loss of streambed through placement of structures;
- turbidity, including the increased potential of sedimentation from construction site runoff;
- water quality, including the potential of sedimentation from construction in areas adjacent to or within water resources (this impact is dependent upon the type of construction, condition of vegetative cover, stormwater management, and landscape terrain);
- flow direction, including potential alteration of stream flow direction through placement of structures in the stream channel during surface water crossings; and
- velocity, including the potential alteration of stream flow velocity through stream channelization, placement of culverts, and other types of stream crossings.

The largest surface waterbody potentially crossed is a perennial stream (West Creek) located along East Corridor Segment A which is approximately 15 feet in width. The average width of the other perennial streams that would be crossed is 7 feet. The intermittent surface water features along the potential corridors average 3 feet in width and the ephemeral features average 1 to 2 feet in width. The use of trenching methods for pipeline crossings over these features could result in minor to moderate temporary adverse impacts to these surface waters (see Table 3.6-6). BMPs, including a combination of stabilization and structural erosion and sediment control methods, would be implemented to further reduce temporary impacts by controlling sedimentation and turbidity and restoring stream crossings to their original grade to stabilize streambanks post construction. Key aspects of the BMPs are to control both surface and subsurface slope drainage, minimize slope erosion, and minimize or prevent channel erosion at stream crossings. Specific types of structural BMPs include installing temporary control structures such as sediment traps and filter fences. Effective drainage and erosion control would also further minimize impacts to surface waters.

Table 3.6-6. Number of Surface Water Crossings for Pipeline Routes

Potential Injection Well Property	Pipeline Route Options	Resource Impact Type[a]									Resource Impact Rating[a]
		Number of Perennial Stream Crossings	Number of Intermittent Stream Crossings	Number of Ephemeral Stream Crossings	Number of Pond/Lake Crossings	Loss of Streambed	Increased Turbidity	Degraded Water Quality	Change of Flow Direction	Change of Velocity	
Mountaineer Plant	Plant Routing										Neg
Borrow Area	Borrow Area Route	1	2	4		Neg	Min	Min	Min	Neg	Min
Eastern Sporn Tract	Eastern Sporn Route 1	5	10	9		Neg	Min	Min	Min	Neg	Min
	Eastern Sporn Route 2	8	20	20		Neg	Mod	Mod	Mod	Neg	Mod
	Eastern Sporn Route 3	3	11	11		Neg	Min	Min	Min	Neg	Min
	Eastern Sporn Route 4	7	17	14		Neg	Mod	Mod	Mod	Neg	Mod
Jordan Tract	Jordan Route 1	11	21	21		Neg	Mod	Mod	Mod	Neg	Mod
	Jordan Route 2	9	19	29		Neg	Mod	Mod	Mod	Neg	Mod
	Jordan Route 3	11	20	24		Neg	Mod	Mod	Mod	Neg	Mod
	Jordan Route 4	9	18	32		Neg	Mod	Mod	Mod	Neg	Mod
Western Sporn Tract	Western Sporn Route	3	10	21		Neg	Min	Min	Min	Neg	Min

Impact Rating Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] As the placement of the pipeline within the potential permanent 50-foot ROW is uncertain at this time, it was assumed that all surface waters existing within the 50-foot ROW could be crossed by the pipeline. This number may decrease once final engineering and design of the pipeline corridor is complete.

Note: Shaded cells in the table indicate no surface water features are present within the pipeline construction ROWs and the resource impact type would not be anticipated.

Disturbances and alterations of the stream bed, stream bank, and bank vegetation would be limited to the maximum extent practicable. The stream diversion would be designed and operated such that it does not scour the stream channel. The trench crossing the stream would be excavated and the pipeline crossing would be as nearly perpendicular to the stream as possible to minimize overall linear disturbance to the stream. Furthermore, a field assessment would be made prior to construction at each crossing to determine the presence of water as well as determine the velocity and sensitivity of the surface water at the time of construction which in turn would determine the trenching method to be employed (e.g., wet or dry trenching).

The potential for stream impacts during construction would be greatest in areas with a high potential for erosion (i.e., steep slopes composed of loose, easily erodible sediments). The most critical of these slopes are the steep approaches to stream crossings where the pipeline trench would be parallel to the slope angle. In these cases, bank erosion could destabilize slopes and sediments could directly enter a receiving water. Stringent erosion and sediment control measures, aggressive slope stabilization measures, and frequent monitoring in accordance with the SWPPP would be implemented during and after construction in the vicinity of these critical areas. Insuring that slope and channel stabilization measures are implemented immediately after construction would reduce potential erosion and downstream water quality impacts. All areas disturbed by construction would be stabilized by mulching, reseeding, or rip-rap placement, and excess spoils would be disposed of such that they would not re-enter the stream.

The accidental release of fuels, lubricants, and coolants used by heavy equipment during pipeline installation could cause an impact to water quality. An SPCC plan, however, would minimize the potential impact of spills of hazardous materials and would minimize the potential for impacts to surface waters during construction.

No surface water crossings would be required for the pipeline routing at the Mountaineer Plant injection well site. However, temporary indirect impacts such as erosion and sedimentation could affect streams located in close proximity to the construction area along the Plant pipeline route. These impacts would be expected to be minor due to the BMPs that would be employed.

Potential pipeline corridor attributes (e.g., ROW width, pipe size, etc.) and methods of installation (e.g.., trenching method) would be essentially the same for each potential pipeline route. Therefore, impacts would be dependent upon the number of stream crossings that would be required. For the pipeline routes that would require stream crossings, the Eastern Sporn Route 1 and 3, Borrow Area Route, and the Western Sporn Route would have the least impact as they would require less than 20 perennial and intermittent surface water crossings. The remaining pipeline route options would have minor to moderate temporary direct impacts discussed above as they would cross the most surface waters (25 to 35), which continuously carry water year round.

Hydrostatic Testing

The construction of new pipelines would require hydrostatic testing to certify their integrity before they can be put into operation. These tests consist of pressurizing the pipelines with water and checking for pressure losses due to pipeline leakage. Hydrostatic testing would be performed in accordance with DOT pipeline safety regulations.

Demineralized water to support hydrostatic testing would be supplied from the existing Mountaineer Plant. No chemical additives would be introduced to the water used to hydrostatically test the new pipelines, and no chemicals would be used to dry the pipelines after the hydrostatic testing. Hydrostatic testing water that could not be reused would be filtered (e.g., through hay bales or other solids-removing media) and released to the Ohio River or a tributary to the river in accordance with all permit and regulatory requirements. An NPDES non-stormwater general permit from the WVDEP would be required to regulate the discharge of hydrostatic testing water. This general permit would require monitoring of discharges and reporting of designated parameters, including oil and grease, total suspended solids, and pH. Since any disposal of hydrostatic testing water would occur in compliance with NPDES permit conditions, minor temporary impacts are expected to local surface water features found near the potential pipelines.

Table 3.6-7 displays the approximate amounts of hydrostatic testing water that would be needed for each route option, assuming that approximately 31,000 gallons of demineralized water would be required for each mile of pipeline. This table conservatively assumes that all pipelines are 12 inches in diameter. Pipe sizing would be determined during final engineering. If a smaller diameter pipeline is used, less water would be required to support testing. The Jordan Tract and all four of its route options would require the most water for hydrostatic testing, meaning these options would have a greater chance of impacting surface waters; however, impacts would be short term and minor.

Table 3.6-7. Hydrostatic Water Needs for Each Pipeline Route

Injection Well Property	Route Options	Length (miles)	Water Needs (gallons)
Mountaineer Plant	Mountaineer Plant Routing	0.13	4,030
Borrow Area	Borrow Area Route	2.24	69,440
Eastern Sporn Tract	Eastern Sporn Route 1	5.00	155,000
	Eastern Sporn Route 2	8.22	254,510
	Eastern Sporn Route 3	5.11	158,410
	Eastern Sporn Route 4	8.65	259,780
Jordan Tract	Jordan Route 1	9.25	286,750
	Jordan Route 2	9.24	286,440
	Jordan Route 3	9.68	300,080
	Jordan Route 4	9.67	297,600
Western Sporn Tract	Western Sporn Route	5.69	176,390

Injection Well Sites

Tables 3.6-8 through 3.6-10 quantify the impacts of construction disturbance to surface waters anticipated from construction at each of the injection well sites. This includes construction of the final length of pipeline (spur) from the pipeline corridor across the AEP property to each injection well site (Table 3.6-8); construction of the injection wells (Table 3.6-9) and construction of any access roads to the injection wells (Table 3.6-10).

The pipeline spurs would be constructed using the same methods and materials as the main pipeline corridors and would share the same attributes (e.g., ROW width, pipe size, etc.). Therefore, typical impacts resulting from construction would be the same as those previously discussed for the construction of the pipeline corridors and BMPs that could be implemented would be the same as well. Table 3.6-8 summarizes potential impacts that could result from the construction of the pipeline spur alternatives. No surface waters exist along the pipeline spurs located within the Mountaineer Plant, Western Sporn Tract, and Borrow Area; therefore, no impacts would occur to surface waters from the construction of these pipeline spurs.

Table 3.6-8. Number of Surface Water Crossings for Pipeline Spurs

Potential Injection Well Property	Final Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Resource Impact Type[a]									Resource Impact Rating
			Number of Perennial Stream Crossings	Number of Intermittent Stream Crossings	Number of Ephemeral Stream Crossings	Number of Pond/Lake Crossings	Loss of Streambed	Increased Turbidity	Degraded Water Quality	Change of Flow Direction	Change of Velocity	
Mountaineer Plant[b]	NA	NA										Neg
Borrow Area	North Segment B	Spur to BA-1										Neg
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1			1		Neg	Neg	Neg	Neg	Neg	Neg
		Spur to ES-2		1			Neg	Min	Min	Min	Neg	Min
		Spur to ES-3		1	2		Neg	Min	Min	Min	Neg	Min
	Eastern Sporn Corridor	Spur to ES-1		1	2		Neg	Min	Min	Min	Neg	Min
		Spur to ES-2		2	3		Neg	Min	Min	Min	Neg	Min
		Spur to ES-3		1	2		Neg	Min	Min	Min	Neg	Min
Jordan Tract	Jordan West Corridor	Spur to JT-1										Neg
	Jordan East Corridor	Spur to JT-1										Neg
Western Sporn Tract[b]	Foglesong Corridor	NA										Neg

Impact Rating Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] As the placement of the pipeline within the potential permanent 50-foot ROW is uncertain at this time, it was assumed that all surface waters existing within the 50-foot ROW could be crossed by the pipeline. This number may decrease once final engineering and design of the CO_2 pipeline is complete.

[b] The Mountaineer Plant and Western Sporn Tract injection well properties spurs would be located within the 5-acre area of disturbance for the injection well sites and therefore are not included in the analysis

Note: Shaded cells in the table indicate no surface water features are present within the pipeline spur construction ROWs and the resource impact type would not be anticipated.

NA = not applicable

Table 3.6-9. Injection Well Site Construction Disturbances to Surface Water Resources

Potential Injection Well Property	Injection Well Site Option	Resource Impact Type					Resource Impact Rating
		Loss of Streambed	Increased Turbidity	Degraded Water Quality	Change of Flow Direction	Change of Velocity	
Mountaineer Plant	MT-1						Neg
Borrow Area	BA-1		Neg	Neg			Neg
Eastern Sporn Tract	ES-1		Neg	Neg			Neg
	ES-2		Neg	Neg			Neg
	ES-3		Neg	Neg			Neg
Jordan Tract	JT-1						Neg
Western Sporn Tract	WS-1						Neg

Impact Rating Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

Note: Shaded cells in the table indicate no anticipated surface water impacts (i.e., resource is absent and construction activity would not generate the impact).

Two ephemeral streams and one intermittent stream exist within the potential 80- to 120-foot construction ROW for the pipeline spur at the Jordan Tract. These streams encroach less than 20 feet into the construction ROW (assuming a 120-foot maximum width); therefore, they would be avoided during construction by limiting the width of the construction ROW in these areas. Indirect minor impacts to these intermittent streams and downgradient receiving waters from sediment transport are possible. These types of impacts could only result during heavy rains storms or during snowmelt when the ephemeral streams are carrying water. These types of indirect impacts could be avoided through the implementation of BMPs.

On the Eastern Sporn Tract, the pipeline spurs to the alternative injection well sites would cross from one to five streams, as shown in Table 3.6-8; however, no perennial streams would be crossed for any pipeline spurs. The pipeline spur option from the Eastern Sporn Corridor to Injection Well Site ES-2 would result in the largest number of crossings (two intermittent and three ephemeral streams). Impacts from in-stream disturbance would occur during the construction and restoration period at each potential crossing. The duration of impacts is expected to be temporary and would be minimized by the implementation of a restoration plan. The potential for minor temporary impacts would extend downstream dependent on flow and mixing conditions.

The 5-acre construction areas for the injection well sites within the Eastern Sporn Tract and Borrow Area contain surface waters, as summarized in Table 3.6-4 and Table 3.6-9; however, no perennial streams exist in these areas. Injection Well Sites ES-2 and ES-3 each contain an ephemeral stream, Injection Well Site ES-1 contains one intermittent and four ephemeral streams, and Injection Well Site BA-1 contains one ephemeral stream. Any selected injection well site at the Eastern Sporn Tract or Borrow Area would be designed so that all ephemeral and intermittent streams would be avoided. Therefore, impacts from the construction of the injection well sites would be limited to potential indirect impacts to nearby streams and downgradient receiving waters from sediment transport. These types of impacts could only result during heavy rains or during snowmelt when the ephemeral streams are carrying water. Should construction take place after a rain event or snowmelt and the ephemeral streams are carrying water the same chance for sediment transport exists and can be avoided through implementation of the SWPPP and the use of BMPs.

Table 3.6-10. Potential Injection Well Site Access Road Construction Disturbances to Surface Water Resources

Potential Injection Well Property	Final Pipeline Segment Option	Injection Well Site Option	Resource Impact Type									Resource Impact Rating
			Number of Perennial Stream Crossings	Number of Intermittent Stream Crossings	Number of Ephemeral Stream Crossings	Number of Pond/Lake Crossings	Loss of Streambed	Increased Turbidity	Degraded Water Quality	Change of Flow Direction	Change of Velocity	
Mountaineer Plant	NA	MT-1										Negligible
Borrow Area	North Segment B	BA-1										Negligible
Eastern Sporn Tract	Blessing Road Segment B	ES-1										Negligible
		ES-2			1							Minor
		ES-3										Negligible
	Eastern Sporn Corridor	ES-1										Negligible
		ES-2			1							Negligible
		ES-3										Minor
Jordan Tract[a]	Jordan West Corridor	JT-1										Negligible
	Jordan East Corridor	JT-1										Negligible
Western Sporn Tract	Foglesong Corridor	WS-1										Negligible

[a] The Jordan Tract injection well site would not require an access road.

Note: Shaded cells in the table indicate no surface water features are present within the road temporary construction ROWs and the resource impact type would not be anticipated.

NA = not applicable

Final project design would incorporate SWPPP requirements and BMPs to ensure that drainage and runoff would occur without excessive erosion and increased turbidity. The use of silt fencing and other erosion control devices would prevent debris from entering nearby streams during construction. The probability of runoff containing oil, and other pollutants from the use of construction vehicles would be minimized by the implementation of an SPCC plan.

One potential access road associated with Injection Well Site ES-2 would cross a surface water feature (see Table 3.6-10). This surface water feature is ephemeral; therefore, should construction take place after a rain event or snowmelt and the ephemeral stream is carrying water the chance for sediment transport exists however can be minimized through the use of BMPs. In addition, one ephemeral stream exists within the access road construction area to Injection Well Site BA-1; however, it encroaches less than 15 feet into the construction area and would be easily avoided during construction. Land disturbing activities in the immediate vicinity of the ephemeral stream could result in minor short-term indirect impacts from sedimentation. The surface water feature is ephemeral; therefore, should construction take place after a rain event or snowmelt while the ephemeral stream is carrying water, the chance for sediment transport would exist. Potential impacts related to sediment transport would be minimized through the use of BMPs or delaying construction until periods of lower flow. As shown in Table 3.6-10, overall adverse impacts to surface waters from access road construction would be negligible to minor.

The injection well sites would not intersect any ponds, lakes, or streams. The construction of the wells would require water to support drilling operations. Approximately 50,400 gallons of freshwater and 63,000 gallons of brine water would be required to support drilling operations for each well. It is anticipated that fresh water would be provided from local sources or trucked to the drilling sites. Brine water would be supplied by a local hauler/supplier. At the Borrow Area, water may be withdrawn from the ash ponds (after the ash has settled out).

As the injection wells could be over 9,000 feet deep, the deep brine pumped during well development would be very saline and would require measures to prevent this water from reaching surface water bodies. Such measures include conducting brine pumping and storage in areas away from surface water resources as well as appropriately storing brine to prevent runoff into nearby surface waters. If groundwater is encountered during the well drilling, the water would be directed to mud pits and hauled offsite by a vendor for appropriate disposal. Any drilling fluids or waste brine generated during drilling would be disposed offsite at a permitted brine disposal well. Potential impacts to surface waters from the construction of the wells would be short term and negligible as a result of the fluid handling procedures that would be employed during the well construction process.

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the geologic characterization study. AEP anticipates the need for one to three monitoring wells per injection well, or per co-located pair of injection wells. Construction of each monitoring well could disturb up to 5 acres. AEP would, to the greatest extent practical, use the siting criteria presented in Section 2.3.1 to site each monitoring well. Based on the siting criteria, it is expected that AEP would avoid streams and wetlands, and related impacts would be similar to those described for the construction of the injection wells.

3.6.3.2 Operational Impacts

CO_2 Capture Facility

The CO_2 capture facility footprint would comprise an area of approximately 11.5 acres, resulting in an increase in the amount of impervious surfaces at the Mountaineer Plant. This increase in impervious surface would increase the potential for stormwater runoff from this area. Additionally, the potential for spills (e.g., fuel, chemicals, grease, etc.) would also exist. Either of these runoff or spill scenarios could cause the potential for an impact to the water quality of the Ohio River. The CO_2 capture facility would comply with NPDES permit conditions, SPCC Plan requirements, and stormwater management and pollution prevention measures which would reduce or eliminate the potential for significant adverse operational impacts. Adherence to applicable laws, regulations, policies, standards, and BMPs would also help to avoid and minimize potential adverse operational impacts to surface waters.

Additionally, water quantity impacts to the Ohio River during operations would occur from the Mountaineer Plant's use and discharge of water. The CO_2 capture facility is expected to require 1.9 mgd of make-up water and 72,000 gpd of demineralized water. This water would be supplied by the existing river water intake system located within the Ohio River. As no new intake structures are required, no new permitting would be necessary. The WVDEP does not require a permit for the withdrawal of water. The WVDEP does, however, require users who withdraw more than 750,000 gallons per month to register with the WVDEP's DWWM and report monthly uses of water as well as an annual report (Stratton, 2010). The Mountaineer Plant is already registered with the WVDEP as they currently use 18.74 mgd; therefore, they would adjust their monthly use reporting accordingly.

As previously discussed, the 7Q10 flow in the Ohio River at the point of the Mountaineer Plants existing withdrawal is approximately 4,400 mgd. The additional withdrawal of approximately 1.9 mgd would bring the Mountaineer Plant's total daily withdrawal to 20.64 mgd which would represent only 0.47 percent of the 7Q10 flow. The additional 1.9 mgd would result in a 0.04 percent increase of the low flow from current operating conditions. This would represent a negligible impact and reduction in the river's flow during low flow conditions.

A new WWTP could be built to handle the additional wastewater associated with the CO_2 capture facility in the event that the existing WWTP at the Mountaineer Plant does not have additional capacity. The wastewater generated by the CO_2 capture facility would be sent to the existing or the new WWTP before being discharged to an existing NPDES permitted outfall. The additional discharges would remain within the limits set forth in AEP's existing NPDES Permit No. WV0048500 and no changes to the facility's permit limits would be required. Potential water quality impacts to biological resources downstream of the Mountaineer Plant are discussed in Section 3.8, Biological Resources.

Amine-Based Capture System Feasibility Study

Emissions of amines to the atmosphere would result from the operation of an amine-based CO_2 capture system. The composition of those emissions would depend, in large part, on the specific amines present in the solvent solution and any additives used to control corrosion or adjust pH. The amines emitted would likely degrade in the atmosphere. Because most amines are water soluble, precipitation would have the potential to transfer emitted amines and degradation products from the atmosphere to water bodies within the ROI. The volume of amines deposited in water bodies would depend, in part, on the volume of amines emitted to the atmosphere, as well as the amount and frequency of rainfall.

Pipeline Corridors

Normal operations of the pipeline corridors would generally not affect surface waters. Occasional maintenance may require access to buried portions of the utilities; however, BMPs, such as strategic placement of silt fencing and temporary drainage controls, would be used to avoid any indirect impacts (e.g., sedimentation and turbidity) to adjacent surface waters. There is also the potential for surface water contamination to occur during maintenance activities should an accidental spill occur, however, the implementation of BMPs and an SPCC plan would reduce or avoid possible impacts.

Injection Well Sites

As with the operation of the pipeline, normal operations would generally not affect surface waters. Maintenance operations would be performed on an infrequent basis and would have the potential to affect surface waters. Maintenance operations may require the use of acid to support acidizing and may generate spent acid and waste brine. These materials would be handled in accordance with the SWPPP for the project such that the potential for spills would be reduced and possible impacts would be avoided.

3.6.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to surface water uses or quality. There would be no effect to surface water under the No Action Alternative.

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3.7 WETLANDS AND FLOODPLAINS

3.7.1 Introduction

This section identifies and describes wetlands and floodplains potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project on these resources. In addition, this section provides the required wetland and floodplain assessment and public review for compliance with regulations promulgated at 10 CFR 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." These regulations provide a guide for DOE compliance with Executive Orders (EOs) 11988, "Floodplain Management," and 11990, "Protection of Wetlands." EO 11988 requires federal agencies, while planning their actions, to avoid to the extent possible adverse impacts associated with the modification of floodplains and to avoid support of floodplain development when there is a practicable alternative. EO 11990 requires that federal agencies, while planning their actions, consider alternatives to affecting wetlands, if applicable, and limit adverse impacts to the extent practicable if they cannot be avoided.

3.7.1.1 Region of Influence

The ROI for wetlands and floodplains includes the Mountaineer Plant property, potential pipeline corridors, and potential injection well sites.

3.7.1.2 Method of Analysis

DOE performed field surveys to locate and delineate wetlands in potentially affected land areas from June through August 2010. A full report of the field delineation effort is included in Appendix E. DOE assessed impacts to wetlands and floodplains primarily by using GIS to calculate impact acreages for field-delineated wetlands and mapped floodplains. Baseline environmental data (i.e., wetlands and floodplains locations) were overlaid with project features to determine the locations and areal extents of potentially affected wetlands and floodplains. In locations where wetlands and floodplains would be impacted, qualitative assessments were made of what those impacts would be, based on the factors considered for assessing impacts described in Section 3.7.1.3.

3.7.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to wetlands and floodplains based on whether the Mountaineer CCS II Project would directly or indirectly

- cause filling of wetlands or otherwise altered drainage patterns that would affect wetlands;
- cause wetland type conversions due to alterations of land cover attributes;
- alter a floodway or floodplain or otherwise impede or redirect flows such that human health, the environment or personal property could be affected;
- conflict with applicable flood management plans or ordinances; or
- conflict with the Federal Emergency Management Agency's (FEMA's) national standard for floodplain management (i.e., maximum allowable increase of water surface elevation of 1 foot for a 1 percent annual chance [100-year recurrence interval] flood event).

3.7.2 Affected Environment

<u>Wetlands</u>

Wetlands have unique characteristics that set them apart from other environments, providing the basis for wetland identification and classification. These unique characteristics include a substrate that is saturated or inundated with water for part of the growing season, soils that contain little or no oxygen, and plants adapted to wet or seasonally saturated conditions. Wetlands serve many functions, including the storage and slow release of surface water, rain, snowmelt, and seasonal floodwaters to surface waters. Additionally, wetlands provide wildlife habitat, sediment stabilization/retention functions, and perform an important role in nutrient (e.g., nitrogen and phosphorus) cycling. They also help to maintain stream flow during dry periods and provide groundwater recharge functions.

> **Wetlands** are defined by the USACE as follows (40 CFR 230): Those areas that are inundated or saturated by surface or ground water 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.

Wetlands are among the most productive environments in the world, comparable to rain forests and coral reefs. Many species of wildlife, including a large percentage of threatened and endangered species, depend on wetlands for their survival. Wetlands are important for their scientific and educational opportunities and can provide open space for recreation where public access is available.

Certain wetland features, called "waters of the U.S.," are regulated by the USACE under the CWA because they are important for the preservation of navigable waterways and interstate commerce. Waters of the U.S. are subject to federal jurisdiction and permitting under Section 404 of the CWA and include all navigable waterways, their tributaries, as well as wetlands contiguous to and adjacent to those navigable waterways and tributaries. Isolated wetlands (those that have no surface hydrologic connection to waters of the U.S.) are not regulated under federal jurisdiction unless they are adjacent to waters of the U.S.

In Mason County, federal wetland regulations are enforced by the USACE Huntington District. Under Section 404 of the CWA, a USACE permit from the Huntington District would be required for the discharge of dredged or fill material into waters of the U.S., which is often authorized by an Individual Permit. In addition, the construction, maintenance, or repair of utility lines (e.g., pipelines) within waters of the U.S. would require a Nationwide Permit 12, "Utility Line Activities," from the Huntington District. In order to receive a permit from USACE, the potential land developer must submit a permit application to USACE containing suitable information for them to make a decision. It is currently unknown whether project activities involving impacts to potential waters of the U.S. would apply for a single project-wide Individual Permit or if development of the pipeline corridors would apply under the Nationwide Permit 12, with potential filling of waters of the U.S. (e.g., for development of the access roads) under a separate Individual Permit. AEP would coordinate with USACE at the appropriate time to determine the preferred approach to project permitting.

Wetland types are typically categorized using the U.S. Fish and Wildlife Service (USFWS) document *Classification of Wetlands and Deepwater Habitats of the United States* (hereafter referred to as the "Cowardin classification") (Cowardin et al., 1979). The purpose of this document is to describe wetland and deepwater habitats using ecological parameters, arrange them into a system useful to resource managers, furnish units for mapping, and provide uniformity of concepts and terms. This classification system is used by the USFWS when categorizing wetland types to develop the National Wetland Inventory (NWI), a series of topical maps that show wetlands and deepwater habitats of the U.S. The classification system consists of a hierarchy that follows the following order: System, Subsystem (applies to riverine features, but not part of the palustrine classification), Class, Subclass, and modifying terms.

> **Hydrophytic vegetation** is defined as macrophytic plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.
>
> **Hydric soils** are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions within the major portion of the root zone.
>
> **Wetland hydrology** is the permanent or periodic inundation or soil saturation for a significant period during the vegetative growing season (USACE, 1987).

Wetland delineations were performed at the potential injection well properties and the pipeline corridor ROWs. The wetland delineation activities were conducted using the

U.S. Army's *Corps of Engineers Wetland Delineation Manual* guidelines based on the three parameter approach (presence of hydrophytic vegetation, hydric soils, and wetland hydrology to qualify as a wetland) (USACE, 1987). DOE representatives identified and marked the locations of all wetland features in the field using flagging tape and subsequently recorded them using the Global Positioning System (GPS).

The following sections describe wetland features within the ROI based on the Cowardin classification. During the wetland delineation effort, palustrine wetlands were classified to the Subclass level (System/Class/Subclass) and riverine wetlands were also classified to the Subclass level (System/Subsystem/Class/Subclass). However, for purposes of analysis in this EIS, riverine wetland types are presented to the Subsystem level. Table 3.7-1 provides descriptions of the classification hierarchy parameters that apply to potentially affected wetland types within the ROI.

Floodplains

Since flooding events can cause very costly natural disasters, FEMA, through the National Flood Insurance Program (NFIP), enables property owners to purchase insurance protection against losses from flooding. Floodplain management activities of the NFIP include the development of Flood Insurance Rate Maps (FIRMs) for flood insurance rating purposes. A FIRM is a map that outlines flood risk zones within communities and is usually issued following a Flood Insurance Study (FIS) that summarizes the analysis of flood hazards within the subject community. FEMA provides FIRMs to a wide range of users including: private citizens, community officials, insurance agents and brokers, lending institutions, and other federal agencies.

A FIS includes detailed engineering studies to map predicted flood elevations at specified flood recurrence intervals. Generally, the FIS is concerned with peak discharges in streams and rivers for 100- and 500-year storm events and includes engineering analyses of predicted flood elevations for each flood recurrence interval. Based on the results of the engineering analyses, flood risk zones are assigned for insurance purposes. The 100-year floodplain is defined as areas that have a 1 percent annual chance of flooding. The 500-year floodplain is defined as areas that have a 0.2 percent annual chance of flooding. Floodplains in the area of the Mountaineer CCS II Project are mapped under three different categories:

- Zone A – 100-year floodplains without mapped base flood elevations (i.e., the elevation to which floodwaters would be expected to rise during a 100-year flood).
- Zone AE – 100-year floodplains with mapped base flood elevations.
- Zone X500 – Areas between 100- and 500-year floodplains, certain areas subject to 100-year floods with average flood depths of less than 1 foot or where the contributing drainage area is less than 1 square mile, or areas protected from 100-year floods by levees.

FEMA has adopted a maximum allowable increase of water surface elevation of 1 foot for a 1 percent annual chance (100-year recurrence interval) flood event as the national standard for floodplain management purposes. Mason County has adopted this national standard in their floodplain ordinance. In addition, Mason County requires that non-residential structures in 100-year floodplains be designed such that structures' lowest floors (including basement) be elevated to or above the base flood elevation unless the structure is flood-proofed below the base flood elevation. The floodplain ordinance identifies 100-year floodplains as those areas shown on the FIRM for Mason County based on a July, 1979 FIS or the most recent revision thereof. Mason County only regulates 100-year floodplains (County Commission of Mason County, 1993).

Currently, FEMA is in the process of producing digital FIRMs of the entire State of West Virginia; however, Mason County data are not yet available. Therefore, this analysis uses GIS data of state-wide 100-year floodplains produced by the West Virginia GIS Technical Center. This dataset compiles information from draft, preliminary, and effective digital FIRM data as well as Q3 Flood Data (these data

Table 3.7-1. Cowardin Classification Codes Applicable to Potentially Affected Wetlands within the ROI

Classification Title	Description
	Systems
Riverine	Includes all wetlands contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 parts per thousand. A channel is an open conduit, either naturally or artificially created, which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water. As per the Cowardin classification, riverine features are considered wetlands in this section. Section 3.6, Surface Water, uses the term “stream” to characterize the riverine wetland features.
Palustrine	Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 20 acres; (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 6.56 feet at low water; and (4) salinity due to ocean-derived salts less than 0.5 parts per thousand. There are no Subsystems associated with this System. These features are considered wetlands.
	Subsystems
Upper Perennial	Gradient is high and velocity of the water fast. There is no tidal influence and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. The natural dissolved oxygen concentration is normally near saturation. The fauna is characteristic of running water, and there are few or no planktonic forms. The gradient is high compared with that of the Lower Perennial Subsystem, and there is very little floodplain development. Associated with the Riverine System.
Lower Perennial	Gradient is low and water velocity is slow. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. Dissolved oxygen deficits may sometimes occur, the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The gradient is lower than that of the Upper Perennial Subsystem and the floodplain is well developed. Associated with the Riverine System.
Intermittent	Defined by the Cowardin classification as: the channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent. In this analysis, the Intermittent Subsystem has been further defined as features that contain water flows seasonally, i.e., they contain flowing water during certain times of the year when groundwater provides water for stream flow. During dry periods, intermittent features may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow. Though not a part of the Cowardin classification, this refined definition has been included because it is information requested by USACE for potential future permitting efforts to make a distinction between Intermittent features and Ephemeral features (described below). Associated with the Riverine System.
Ephemeral	This subsystem is technically included within the Intermittent Subsystem (described above) and is not considered a distinct subsystem in the Cowardin classification. Features have been further defined as Ephemeral in this analysis as information that USACE has requested for potential future permitting efforts. This subsystem is identical to the Intermittent Subsystem described above; however, periods of flowing water coincide with rain events as opposed to the seasonal nature of flow associated with Intermittent features. Associated with the Riverine System.

Table 3.7-1. Cowardin Classification Codes Applicable to Potentially Affected Wetlands within the ROI

Classification Title	Description
	Classes
Forested	Includes areas dominated by woody vegetation 20 feet tall or taller. All water regimes except subtidal are included. Associated with the Palustrine System.
Scrub-Shrub	Includes areas dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. All water regimes except subtidal are included. Associated with the Palustrine System.
Emergent	Characterized by erect, rooted, herbaceous hydrophytes (i.e., plants that grow only in water or very moist soil), excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed. Associated with the Palustrine System.
Subclasses	
Broad-Leaved Deciduous	In the Palustrine System typical dominant vegetation includes alders (*Alnus spp.*), willows (*Salix spp.*), buttonbush (*Cephalanthus occidentalis*), red osier dogwood (*Cornus stolonifera*), honeycup (*Zenobia pulverulenta*), spirea (*Spiraea douglasii*), bog birch (*Betula pumila*), and young trees of species such as red maple (*Acer rubrum*) or black spruce (*Picea mariana*). Associated with the Palustrine System and Scrub-Shrub Class.
Persistent Emergent	Dominated by plant species that normally remain standing at least until the beginning of the next growing season. Associated with the Palustrine System and Emergent Class.

Source: Cowardin et al., 1979
ROI = region of influence; USACE = U.S. Army Corps of Engineers

show special flood hazard areas identified by FEMA in hardcopy maps; however, when digitized, certain data deficiencies [e.g., map edge-matching errors] have not been corrected). There are FIRMs available for the Mountaineer Plant (Community-Panel Numbers 5401120105A and 5401120110A, dated January 2, 1980), which have been included in the West Virginia GIS Technical Center data; however, they pre-date the construction of the Mountaineer Plant.

3.7.2.1 CO_2 Capture Facility

Wetlands

There are no wetlands located within or adjacent to the land area proposed for the CO_2 capture facility and proposed barge unloading area. There is a small (less than 0.1 acre) palustrine emergent wetland in the center of a depression to the southwest of the barge unloading area that accepts drainage from interior portions of the site and then discharges to the Ohio River. There are wetlands shown by the NWI as being located outside the ROI in other areas of the existing Mountaineer Plant property consisting of several man-made lagoons supporting the power plant's operations (USFWS, 2010a).

Floodplains

The land area proposed for the CO_2 capture facility within the existing Mountaineer Plant property, including the construction laydown area, is entirely within FEMA-mapped floodplains associated with the Ohio River (see Figure 3.7-1). The majority of the overall existing Mountaineer Plant is located in areas designated as Zone AE (100-year floodplains) and areas designated as Zone X500 (areas between 100- and 500-year floodplains). Within the approximately 33-acre area of disturbance associated with construction of the CO_2 capture facility, approximately 13 acres occur in the FEMA-mapped 100-year floodplain (Zone AE) and 20 acres occur in the Zone X500 floodplain. The base flood elevation of the site is identified as being 582 feet amsl (West Virginia GIS Technical Center, 2010). Since the FEMA maps were published, the site has been elevated substantially for the development of the Mountaineer Plant. At present, the majority of the land area proposed for the CO_2 capture facility ranges from approximately 585 to 588 feet amsl (AEP, 2002); 3 to 5 feet higher than the mapped base flood elevation. A portion of the site containing one of three optional locations for the cooling tower (the easternmost optional location, see Figure 3.7-1) would be located on land ranging from 580.7 to 582.3 feet amsl (mostly in the 581.5 feet amsl range) (AEP, 2002), which is generally at or below the mapped base flood elevation of 582 feet amsl. In addition, the land area proposed for the upgrades to the existing barge unloading area (approximately 0.28 acres) would be located within the FEMA-mapped 100-year floodplain on land ranging from approximately 545 feet amsl to 567 feet amsl (AEP, 2002), well below the mapped base flood elevation of 582 feet amsl.

3.7.2.2 Pipeline Corridors

Wetlands

Overall, the vast majority of wetland features within the pipeline corridors are riverine features. The Mountaineer Plant routing would not cross any wetland features. It is important to note that the middle third portion (approximately 2,890 linear feet) of the Jordan East Corridor was not field investigated because it is private property and access was not permitted; thus, there may be wetland features present in this area that are not accounted for in this analysis. However, there are no NWI-mapped wetlands and no surface water features were identified on USGS topographic maps or aerial photography along the portion of the corridor that was not surveyed by DOE.

There are two palustrine wetland areas just outside the Mountaineer Plant adjacent to, and on the east side of, Little Broad Run, which would be within the construction ROW of North Corridor Segment A. One is classified as Palustrine/Scrub-Shrub/Broad-Leaved Deciduous, 3.94 acres of which would be contained within the construction ROW (including the permanent ROW). The second wetland, located just south of the first wetland area, is classified as Palustrine/Emergent/Persistent Emergent and of which 1.29 acres would be contained within the construction ROW (including the permanent ROW). One other palustrine

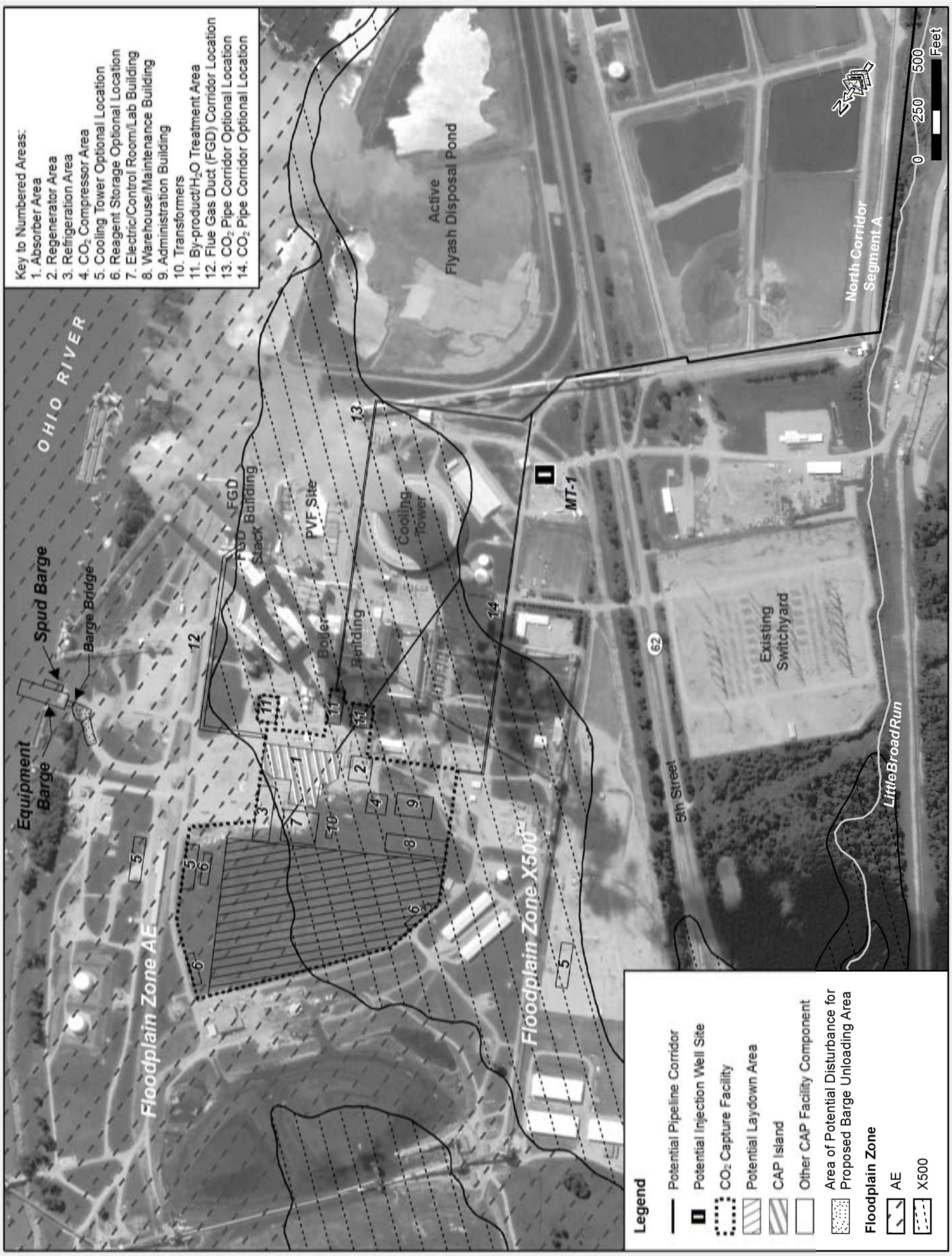

Figure 3.7-1. Floodplains at the Proposed CO_2 Capture Facility

wetland (classified as Palustrine/Emergent/Persistent Emergent) occurs along South Corridor Segment D, approximately 0.3 mile south of where South Corridor Segment C intersects with Blessing Road. Approximately 0.28 acre of this wetland would be within the construction ROW for the pipeline including the permanent ROW.

Table 3.7-2 presents the total number of riverine wetland features within each of the pipeline corridors. The areal extent of riverine wetland features within the pipeline corridors are presented in Sections 3.7.3.1 and 3.7.3.2. The majority of the identified riverine wetland features are intermittent or ephemeral. The majority of perennial features are considered lower perennial, which is likely due to the relatively close proximity of the project to the Ohio River leading to a relatively low elevation in the landscape.

Table 3.7-2. Numbers of Riverine Wetland Features within Pipeline Route Options

Corridor	Potential Pipeline Segments	Riverine / Upper Perennial	Riverine / Lower Perennial	Riverine / Intermittent	Riverine / Ephemeral
Mountaineer Plant	Plant Routing	0	0	0	0
North Corridor	North Corridor Segment A	0	1	0	0
	North Corridor Segment B	0	0	2	5
	North Corridor Segment C	0	0	1	4
	Total	**0**	**1**	**3**	**9**
South Corridor	South Corridor Segment A	0	1	3	0
	South Corridor Segment B	1	1	2	0
	South Corridor Segment C	0	0	2	0
	South Corridor Segment D	1	2	4	9
	South Corridor Segment E	0	0	2	2
	Total	**2**	**4**	**13**	**11**
Blessing Road Corridor	Blessing Road Corridor Segment A	0	2	0	0
	Blessing Road Corridor Segment B	0	0	0	2
	Total	**0**	**2**	0	**2**
East Corridor	East Corridor Segment A	0	1	3	2
	East Corridor Segment B	0	1	0	1
	Total	**0**	**2**	**3**	**3**
Eastern Sporn Corridor	Eastern Sporn Corridor	1	0	6	6
Jordan West Corridor	Jordan West Corridor	0	4	7	3
Jordan East Corridor	Jordan East Corridor	0	2	3	11
Western Sporn Corridor	Western Sporn Corridor	0	2	10	20
Foglesong Corridor	Foglesong Corridor	0	0	2	8

Note: This table shows total numbers of features that occur within the potential pipeline route option construction ROWs including the permanent ROW.

Floodplains

Mapped floodplains occur along one of the potential pipeline corridor segments (see Table 3.7-3 and Figure 3.7-2): the Western Sporn Corridor (West Virginia GIS Technical Center, 2010). There are no mapped floodplains that would occur within the ROWs for the remaining pipeline corridors.

Table 3.7-3. Floodplains Located within the Rights-of-Way of the Potential Pipeline Corridors

Potential Corridor	Name of Watercourse Associated with 100-Year Floodplain	Area in Acres within Construction ROW Including Permanent ROW	Area in Acres within Permanent ROW
Western Sporn Corridor	Broad Run	Zone A – 1.86	Zone A – 0.51

Source: West Virginia GIS Technical Center, 2010
ROW = right-of-way

3.7.2.3 Injection Well Sites

Wetlands

Five AEP-owned properties have been proposed for the location of injection and monitoring wells. At each of these properties, AEP also identified preferred sites for the injection wells (see Section 2.3.5.1). DOE conducted detailed field studies at all of the potential injection well properties; however, the detailed field survey at the Western Sporn Tract was limited to the 5-acre injection well site, while only a reconnaissance-level site walkover was conducted over the remainder of the property. The survey at the Western Sporn Tract was limited because it is the least preferred property. Likewise, the detailed field survey at the Mountaineer Plant was limited to the 5-acre injection well site and the 33-acre CO_2 capture facility site. This section addresses all wetlands identified on the injection well properties, while Sections 3.7.3.1 and 3.7.3.2 focus on the potential impacts to wetlands within the 5-acre injection well sites.

The vast majority of wetland features within each property are riverine features. Table 3.7-4 provides a summary of features located within each of the properties. There are no wetlands located within the area identified at the Mountaineer Plant property for an injection well site. The Borrow Area property contains one wetland feature classified as riverine, which covers 0.01 acre of surface area. The Eastern Sporn Tract contains 119 wetland features that, cumulatively, total 4.58 acres of surface area (0.21 acre of palustrine features; 4.37 acres of riverine features). The Jordan Tract contains 46 wetland features, each of which is classified as riverine, for a total of 1.22 acres of surface area. Wetland delineations were not performed for the entire Western Sporn Tract. Field delineations were limited to the injection well site, pipeline spur, and access road; however, the field investigation did not identify any wetlands in these areas. Two perennial riverine features were identified but not mapped on the Western Sporn Tract: Tenmile Creek and an unnamed tributary. NWI mapping does not show any wetland areas in the Western Sporn Tract (USFWS, 2010a).

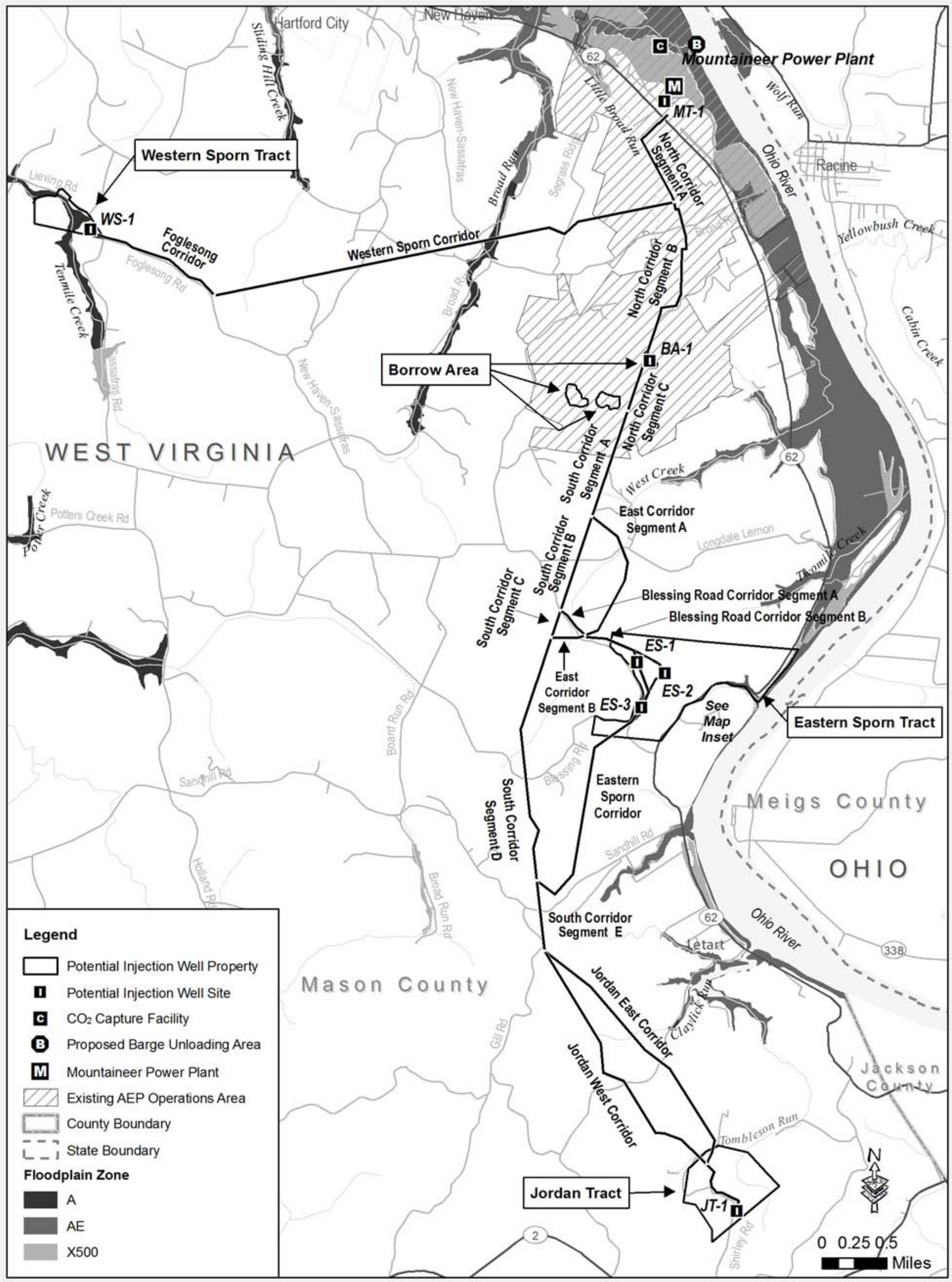

Figure 3.7-2. Floodplains in the Project Area

Table 3.7-4. Wetland Features Located within the Potential Injection Well Properties

Potential Injection Well Property	Cowardin Classification	Wetland Area within Potential Injection Well Property (acres)	Number of Features Present
Mountaineer Plant	None	0	0
Borrow Area	Riverine/Ephemeral	0.01	1
Eastern Sporn Tract	Palustrine/Scrub-Shrub/ Broad-Leaved Deciduous	0.18	2
	Palustrine/Forested/ Broad-Leaved Deciduous	0.03	1
	Riverine/Ephemeral	0.64	90
	Riverine/Intermittent	1.57	25
	Riverine/Upper and Lower Perennial	2.16 (0.06 upper; 2.10 lower)	1
	Total	4.58	119
Jordan Tract	Riverine/Ephemeral	0.31	36
	Riverine/Intermittent	0.39	9
	Riverine/Lower Perennial	0.52	1
	Total	1.22	46
Western Sporn Tract[a]	Riverine/Perennial	0.38	2

[a] Wetland delineations were not performed of the entire Western Sporn Tract. The field investigation noted no wetlands in the potential injection well site, pipeline spur, and access road areas. Two perennial riverine features were identified on the Western Sporn Tract (Tenmile Creek and an unnamed tributary), which are the features noted. NWI mapping does not show any wetland areas in the Western Sporn Tract (USFWS, 2010a); however, it is possible that additional, most likely riverine features may be present.

Floodplains

There are no mapped floodplains that would occur within the Jordan Tract or the Borrow Areas. Mapped floodplains occur within the Eastern Sporn Tract and Western Sporn Tract; however, none occur within any of the associated potential injection well sites (see Table 3.7-5 and Figure 3.7-2) (West Virginia GIS Technical Center, 2010).

Table 3.7-5. Floodplains Located within the Potential Injection Well Properties

Potential Injection Well Property	Name of Watercourse Associated with 100-Year Floodplain	Floodplain Area within Potential Injection Well Property (acres)	Floodplain Area within Potential Injection Well Sites (acres)
Mountaineer Plant	Not Applicable	0	MT-1: 0
Borrow Area	Not Applicable	0	BA-1: 0
Eastern Sporn Tract	Ohio River	Zone AE – 7.17	ES-1: 0
		Zone X500 – 3.40	ES-2: 0
		--	ES-3: 0
Total Eastern Sporn Tract Floodplain Area		10.57	--
Jordan Tract	Not Applicable	0	JT-1: 0
Western Sporn Tract	Tenmile Creek	Zone A – 17.30	WS-1: 0

Source: West Virginia GIS Technical Center, 2010

3.7.3 Direct and Indirect Impacts of the Proposed Action

This section presents potential impacts to surface water features and wetlands (specifically waters of the U.S.) within the ROI. DOE assessed the potential for impacts to wetlands and floodplains in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.7.1.3. Potential impacts are focused on project attributes that could potentially require a permit from the USACE, such as the potential placement of fill material (permitted under Section 404 of the CWA) and the development of utility lines (permitted under Nationwide Permit 12 "Utility Line Activities"). Therefore, this section discusses the potential for impacts related to the loss of resources (i.e., filling impacts), type conversions (e.g., converting a forested wetland to herbaceous vegetation), and surface disturbances within waters of the U.S.; each of these actions ultimately affect the functions and values of surface water and wetland resources (e.g., flood flow attenuation and providing habitat for fish and wildlife). Section 3.6, Surface Water, addresses impacts to surface waters focusing on water quality and their availability for use as a resource.

For wetland impacts, three types of potential impacts could occur:

- Direct wetland loss by placement of fill material and/or structures (fill material is defined by the applicable regulatory agencies [USACE and EPA] as *"…in both the Corps' and EPA's regulations as material placed in waters of the U.S. where the material has the effect of either replacing any portion of a water of the United States with dry land or changing the bottom elevation of any portion of a water.*" [Federal Register, Volume 67, Number 90])
- Wetland type conversions where project activities would cause changes to the vegetation community of the wetland
- Wetland disturbances, which are generally considered temporary, construction-related impacts

Floodplain impacts were assessed for the placement of fill material or structures in a floodplain in a manner that would expose people or structures to increased levels of flood hazards or violate FEMA's national standard for floodplain management.

3.7.3.1 Construction Impacts

CO_2 Capture Facility

Wetlands

There are no wetlands located within the land area proposed for the CO_2 capture facility, including the construction laydown area and barge unloading area; therefore, no impacts to wetlands would occur from the CO_2 capture facility construction. The barge unloading area is located within 50 feet of a palustrine emergent wetland. This wetland area would not be directly disturbed during construction; however, minor, indirect, short-term impacts of sedimentation could occur as a result of land grading activities. Sedimentation impacts would be minimized through implementation of the SWPPP required for NPDES permitting, which would include BMPs to control eroded sediments (e.g., use of filter fencing).

Floodplains

The entire approximately 33-acre area of disturbance associated with construction of the CO_2 capture facility, including the construction laydown area, occurs within mapped floodplains. Approximately 13 acres at this site are within a 100-year floodplain (Zone AE), while the remainder is considered Zone X500. As discussed in Section 3.7.2.1, the FEMA floodplain mapping at the site predates the development of the Mountaineer Plant, which resulted in most of the 33-acre disturbance area being elevated above the mapped base flood elevation of 582 feet amsl. The only potential feature that would occur on land below the mapped base flood elevation would be one of three optional locations for the cooling tower (the easternmost option – see Figure 3.7-1), which would be on land that is mostly in the range of 581.5 feet amsl. It is likely that most of the features would be constructed on land that is already above the 100-year floodplain, possibly within Zone X500 floodplain; however, no FIS has been conducted since the latest FEMA FIRMs were published in 1980.

During construction, it is assumed that the entire area would be disturbed, while the CAP facility itself would ultimately occupy an area of approximately 500 feet by 1,000 feet. In addition, the land area proposed for the upgrades to the existing barge unloading area (approximately 0.28 acres) would be located within the FEMA-mapped 100-year floodplain on land ranging from approximately 545 feet amsl to 567 feet amsl (AEP, 2002), well below the mapped base flood elevation of 582 feet amsl. Land grading associated with the barge unloading facility upgrades would be expected to have a negligible impact on flood hazards. The grading cuts into the river bank may allow a slightly increased volume of water onto the site initially during a flood event; however, the altered area would be relatively small (approximately 80 feet by 40 feet) and would not be expected to cause a measurable increase in flood elevations or noticeable redirection of flood flows.

The temporary presence of construction equipment and materials would cause a minor temporary direct impact of placing materials within the floodplain that could redirect flood flows in the event a flooding incident occurred during construction. Impacts would not endanger human health or property or conflict with any state, local, or federal floodplain ordinances, as equipment would represent relatively small obstructions compared to the overall area of the Ohio River floodplain. In addition, the construction contractor would monitor weather forecasts in the area and, if a large storm were anticipated to occur while equipment was located in the floodplain, move the equipment out of the floodplain prior to any incidents of flooding.

Pipeline Corridors

Wetlands

Potential impacts to wetland areas by wetland type are provided in Table 3.7-6. The table presents the areas of wetlands that could be disturbed during construction activities within the construction ROWs for the pipeline routes. These values were obtained by conservatively assuming the entire width of the construction ROW (using a width of 120 feet) would be disturbed during construction activities.

Within the pipeline corridors, no activities are proposed that would involve the placement of fill material into wetlands or waters of the U.S. Overall, the majority of pipeline construction impacts to wetlands would be temporary and minor, consisting of short-term disturbances during pipeline construction. The pipeline construction ROWs (approximately 80 to 120 feet wide, though in some locations up to 144 feet if necessary due to topography) would be cleared of woody vegetation and the ground surface disturbed, primarily by the movement of equipment, digging of trenches, and stockpiling of excavated soils. These activities would cause soil disturbances and compaction, which could alter wetland hydrology. Within riverine wetlands, the temporary disturbances would represent minor, direct short-term impacts. It is important to note that riverine wetlands outside of the 50-foot wide permanent ROW would not be directly disturbed by trenching, since the pipelines would be placed within the permanent (operational) ROW.

Following construction, the beds, banks, and contours of riverine features would be restored to their preexisting conditions to the extent practicable as required by permit conditions. Following trench digging and pipeline installation in wetland areas, excavated wetland soils would be backfilled into the trenches so that the deepest soils excavated are returned as the deepest soils backfilled. This method of wetland soil backfilling would help maintain pre-construction wetland soil characteristics following construction. In riverine wetlands, the original substrates of the features would be returned to the channels at the surface to restore preexisting beds of these features. In palustrine wetlands, topsoil would be returned at the surface to promote re-vegetation of disturbed areas and restore the preexisting soil conditions.

Table 3.7-6. Pipeline Construction Disturbance to Wetlands

Potential Injection Well Property	Pipeline Route Options	Temporary Construction Disturbance (acres)							Resource Impact Rating
		Palustrine / Scrub-Shrub / Broad-Leaved Deciduous	Palustrine / Emergent / Persistent Emergent	Riverine / Upper Perennial	Riverine / Lower Perennial	Riverine / Intermittent	Riverine / Ephemeral	Total Wetland Disturbance	
Mountaineer Plant	Plant Routing	0	0	0	0	0	0	0	Negligible
Borrow Area	Borrow Area Route	3.94	1.29	0	0.09	0.02	0.02	5.36	Minor
Eastern Sporn Tract	Eastern Sporn Route 1	3.94	1.29	<0.01	0.14	0.11	0.05	5.54	Minor
	Eastern Sporn Route 2	3.94	1.57	0.13	0.08	0.18	0.10	6.00	Minor
	Eastern Sporn Route 3	3.94	1.29	0	0.14	0.13	0.05	5.55	Minor
	Eastern Sporn Route 4	3.94	1.57	0.04	0.19	0.18	0.13	6.05	Minor
Jordan Tract	Jordan Route 1	3.94	1.57	0.02	0.33	0.24	0.11	6.21	Minor
	Jordan Route 2	3.94	1.57	0.02	0.21	0.19	0.14	6.07	Minor
	Jordan Route 3	3.94	1.57	0.02	0.37	0.24	0.12	6.26	Minor
	Jordan Route 4	3.94	1.57	0.02	0.26	0.19	0.16	6.14	Minor
Western Sporn Tract	Western Sporn Route	3.94	1.29	0	0.09	0.23	0.13	5.68	Minor

ROW = right-of-way

Within palustrine wetlands, additional impacts could consist of wetland type conversions. Common type-conversion impacts, identified as the conversion from one wetland type into another (primarily forested and shrub/scrub wetland conversion into emergent systems with herbaceous vegetation), would occur within the construction ROWs. The potential for conversion would occur due to the removal of woody vegetation within the construction ROW, which does not involve the removal of below ground biomass (i.e., roots) or disturbance of soil below the surface. Initially, wetlands would either be converted from one vegetative class into another or to an un-vegetated, bare-soil state due to construction-related surface disturbances (e.g., equipment movement).

Following construction, the portion of the construction ROWs outside of the permanent ROWs would be seeded with vegetation species appropriate to the area and allowed to reestablish (scheduled maintenance of the permanent ROW would result in the permanent conversion of the cover types). Therefore, within the portions of construction ROWs in palustrine wetlands outside of the permanent ROWs, permanent wetland type conversions would not occur; however, the type conversion impacts would be considered long term, especially in forested areas, as it could take a considerable length of time for the vegetation to be reestablished. Consequently, the types and magnitude of wetland functions would change. Typical examples of changed wetland functions could include alterations to wildlife habitat, flood flow attenuation, and sediment stabilization and retention functions. Overall, minor direct impacts to palustrine wetlands would be expected as relatively small amounts of wetland areas would be affected (5.23 acres each for the Borrow Area Route, Eastern Sporn Routes 1 and 3, and the Western Sporn Route; 5.51 acres each for Eastern Sporn Routes 2 and 4 and Jordan Routes 1 through 4).

No filling of wetlands is proposed for development of the pipeline corridors; therefore, no USACE permit to fill wetland areas would be required. Prior to construction, AEP would be responsible for obtaining a USACE Nationwide Permit 12, "Utility Line Activities," or an Individual Permit from the Huntington District for authorization to construct the pipelines through wetland areas considered waters of the U.S.

Floodplains

As described in Table 3.7-3, the Western Sporn Corridor would be the only pipeline corridor that would cross any mapped floodplains. Within its construction ROW (including the permanent ROW), the Western Sporn Corridor would cross 1.86 acres of 100-year floodplain (Zone A) associated with Broad Run. The pipeline corridor would also cross Broad Run.

During construction there may be minor direct temporary impacts to this floodplain area caused by the installation of the pipeline. Construction of the pipeline through Broad Run would likely be performed using an excavated trenching method, which would include development of a diversion channel, with appropriate sediment controls in place (e.g., filter fencing and riprap), to maintain stream flow. The pipeline trench would be approximately 2 to 3 feet deep and 5 feet wide. Trench development within the streambed and adjacent floodplain itself would not be expected to increase flood hazards in the area as trenches would not cause an increase in flood elevations and the diversion channel would be in place to maintain stream flow. However, the temporary presence of construction equipment and spoil piles would cause a minor temporary direct impact of placing materials within the floodplain that could redirect flood flows in the event a flooding incident occurred during construction in the floodplain. It is not expected that this impact would reach a level of endangering human health or property or conflict with any state, local, or federal floodplain ordinances as equipment and soil piles would be contained within the construction ROW and would represent relatively small obstructions as compared to the overall area of the floodplain. In addition, construction personnel would monitor weather forecasts in the area and, if a large storm were anticipated to occur while equipment was located in the floodplain, move the equipment out of the floodplain prior to any incidents of flooding.

Following installation of the pipeline, excavated soils would be backfilled into the trench and all disturbed land areas and streambeds would be returned to their original topography to the extent practicable. Exposed soil areas would be reseeded with vegetation appropriate to the region.

Injection Well Sites

Wetlands

Each injection well site would include a pipeline spur, a 5-acre construction laydown area, and an access road. These features are discussed below.

Impacts to wetland areas by wetland type are provided in Table 3.7-7 for pipeline spur construction. The table presents the areas of wetlands that would be disturbed during construction activities within the pipeline spur construction ROWs. These values were obtained by conservatively assuming the entire width of the construction ROW (using a width of 120 feet) would be disturbed during construction activities.

Table 3.7-7. Potential Pipeline Spur Construction Disturbance to Wetlands

Potential Injection Well Property	Final Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Temporary Construction Disturbance (acres)			Resource Impact Rating
			Riverine / Ephemeral	Riverine / Intermittent	Total Wetland Disturbance	
Mountaineer Plant	NA	NA	0	0	0	Negligible
Borrow Area	North Segment B	Spur to BA-1	0	0	0	Negligible
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1	0.001	0.003	0.004	Minor
		Spur to ES-2	0	0.013	0.013	Minor
		Spur to ES-3	0.003	0.014	0.017	Minor
	Eastern Sporn Corridor	Spur to ES-1	0.004	0.011	0.015	Minor
		Spur to ES-2	0.010	0.023	0.033	Minor
		Spur to ES-3	0.009	0.017	0.026	Minor
Jordan Tract	Jordan West Corridor	Spur to JT-1	<0.001	<0.001	0.001	Minor
	Jordan East Corridor	Spur to JT-1	<0.001	<0.001	0.001	Minor
Western Sporn Tract	Foglesong Corridor	Spur to WS-1	0	0	0	Negligible

NA = not applicable; ROW = right-of-way

The only pipeline spurs that could affect wetlands are those associated with the Eastern Sporn Tract and Jordan Tract. Each potentially affected wetland type would be riverine and would produce similar impacts to those described above for the pipeline corridors. Impacts would result from temporary construction-related disturbances (e.g., equipment movement), which would represent minor direct short-term impacts. Impacts within pipeline spur construction ROWs would be similar to those described above for riverine features in the pipeline corridors; stream crossing techniques and restoration methods would also be similar.

No filling of wetlands is proposed for development of the pipeline spurs; therefore, no USACE permit to fill wetland areas would be required. Prior to construction, AEP would be responsible for obtaining a USACE Nationwide Permit 12, "Utility Line Activities," or an Individual Permit from the Huntington District for authorization to construct the pipeline spurs through wetland areas considered waters of the U.S.

Impacts to wetland areas by wetland type are provided in Table 3.7-8 for well construction. The table presents the areas of wetlands that could be disturbed during construction activities within the 5-acre construction laydown areas.

The only injection well property where well construction activities would affect wetlands would be at Eastern Sporn Tract. The laydown area for Injection Well Site ES-1 would include the greatest amount of wetland area (0.032 acre), while ES-2 and ES-3 would affect a lesser extent (0.003 acre each). Potentially affected wetland areas would be avoided for the actual placement of equipment or materials and would not be directly disturbed by construction activities. However, land disturbing activities in the immediate vicinity of wetland areas could result in minor short-term indirect impacts of sedimentation to these riverine features. Sedimentation impacts would be minimized through implementation of the SWPPP required for NPDES permitting, which would include BMPs to control eroded sediments (e.g., use of filter fencing). Should any additional well locations be developed in any of the injection well properties, one of AEP's siting criteria (see Section 2.3.1) would be to avoid placing them within any wetland areas. Therefore, development of any additional well locations would be expected to cause no greater than minor and temporary indirect impacts of sedimentation if construction laydown areas are in close proximity to wetlands.

Table 3.7-8. Potential Injection Well Construction Disturbance to Wetlands

Potential Injection Well Property	Injection Well Site Option	Temporary Construction Disturbance (acres)			Resource Impact Rating
		Riverine / Ephemeral	Riverine / Intermittent	Total Wetland Disturbance	
Mountaineer Plant	MT-1	0	0	0	Negligible
Borrow Area	BA-1	0	0	0	Negligible
Eastern Sporn Tract	ES-1	0.013	0.019	0.032	Minor
	ES-2	0.003	0	0.003	Minor
	ES-3	0.003	0	0.003	Minor
Jordan Tract	JT-1	0	0	0	Negligible
Western Sporn Tract	WS-1	0	0	0	Negligible

Table 3.7-9 summarizes the impacts by wetland type for access road construction at each injection well site. The table presents the areas of wetlands that would be disturbed during construction activities within the access road construction ROWs.

The only injection well site access roads that would potentially affect wetland areas would be associated with Injection Well Sites BA-1 and ES-2, which would include 0.001 and 0.002 acre of riverine wetlands within construction ROWs respectively. Potentially affected wetland areas would be avoided for the actual placement of equipment or materials and would not be directly disturbed by construction activities. However, land disturbing activities in the immediate vicinity of wetland areas could result in minor short-term indirect impacts of sedimentation to these riverine features. Sedimentation impacts would be minimized through implementation of the SWPPP required for NPDES permitting, which would include BMPs to control eroded sediments (e.g., use of filter fencing). The vast majority of wetland features in the area are riverine; thus, it is most likely that any wetlands affected would also be riverine. Construction of the access roads through riverine features could require filling them, which would remove them from existence altogether and require a permit from the USACE Huntington District.

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permit requirements (see Section 2.3.5.2). The quantity and location of the monitoring wells would be determined during the UIC permitting process and based in part on the results of the geologic characterization study. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. Construction of each monitoring well could disturb up to 5 acres. AEP would, to the greatest extent practicable, use the siting criteria presented in Section 2.3.1.

Table 3.7-9. Potential Injection Well Site Access Road Construction Disturbance to Wetlands

Potential Injection Well Property	Final Pipeline Segment Option	Injection Well Site Option	Temporary Construction Disturbance (acres)	Resource Impact Rating
			Riverine / Ephemeral	
Mountaineer Plant	NA	MT-1	0	Negligible
Borrow Area	North Segment B	BA-1	0.001	Minor
Eastern Sporn Tract	Blessing Road Segment B	ES-1	0	Negligible
		ES-2	0.002	Minor
		ES-3	0	Negligible
	Eastern Sporn Corridor	ES-1	0	Negligible
		ES-2	0.002	Minor
		ES-3	0	Negligible
Jordan Tract	Jordan West Corridor	JT-1	0	Negligible
	Jordan East Corridor	JT-1	0	Negligible
Western Sporn Tract	Foglesong Corridor	WS-1	0	Negligible

NA = not applicable; ROW = right-of-way

Based on these criteria, it is expected that AEP would avoid wetlands, streams, floodplains, and sensitive habitats. The potential impacts to wetlands would be similar to those described for the injection well sites. Potentially affected wetland areas would be avoided for the actual placement of equipment or materials and would not be directly disturbed by construction of the monitoring wells. However, land disturbing activities in the immediate vicinity of wetland areas could result in minor short-term indirect impacts of sedimentation during construction.

Floodplains

As described in Table 3.7-5, the only properties that contain any mapped floodplains are the Eastern Sporn and Western Sporn Tracts. The Eastern Sporn Tract contains 10.57 acres of floodplains associated with the Ohio River (7.17 acres in Zone AE and 3.40 acres in Zone X500); however, none of the Injection Well Sites (ES-1, ES-2, and ES-3) are located within any floodplain areas, nor are any of the access roads. In fact, the closest injection well site to any mapped floodplains (ES-2) is approximately 0.5 mile away.

The Western Sporn Tract contains 17.3 acres of floodplains associated with Tenmile Creek (Zone A); however, the Injection Well Site (WS-1) is not located within the floodplain area, nor is the access road. Injection Well Site WS-1 is located approximately 100 feet from the boundary of the floodplain area and generally up-gradient (0 to 40 feet). Therefore, during land preparation for installation of the well (e.g., land grading), it is possible that sedimentation could occur to the floodplain area via wind and water erosion. During construction, standard BMPs related to sediment control would be employed (e.g., filter fencing). Therefore, it is not expected that sediments would be eroded at a level that would cause any increase in flood elevations or redirect flood flows, and negligible indirect impacts would result.

AEP would be required by WVDEP to install monitoring wells as part of their UIC permit requirements (see Section 2.3.5.2). The quantity and location of the monitoring wells would be determined during the UIC permitting process and based in part on the results of the geologic characterization study. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. Construction of each monitoring well could disturb up to 5 acres. AEP would, to the greatest extent practicable, use the siting criteria presented in Section 2.3.1. Based on the siting criteria, it is expected that AEP would avoid floodplains, and related impacts would be similar to those described for the construction of the injection wells.

3.7.3.2 Operational Impacts

CO_2 Capture Facility

Wetlands

There are no wetlands located within the land area proposed for the CO_2 capture facility; therefore, no impacts to wetlands would occur at the CO_2 capture facility.

Floodplains

The CO_2 capture facility would be located entirely within mapped floodplains (Zone AE [100-year floodplain] and Zone X500 [between 100-year and 500-year floodplain]), though the majority of the facilities would be located outside of the 100-year floodplain within the Zone X500 floodplain. As stated in Section 3.7.2.1, the FEMA mapping of these floodplains represents a historic condition of the site prior to the development of the Mountaineer Plant. In considering the impacts described below, it is likely that all of the potential structures, except for the easternmost optional location for a proposed cooling tower, would be located on land that is actually above the 100-year floodplain considering that the areas are 3 to 5 feet higher than the base flood elevation published by FEMA in 1980. However, no FIS has been conducted in the area since that time; therefore, specific information on the boundaries and extents of presently-existing floodplains is not available.

Currently, there are optional locations identified by AEP for a proposed cooling tower (covering approximately 8,800 square feet of land area) and reagent storage area (covering approximately 6,400 square feet of land area). For each of these proposed structures there are two options that would place them within the mapped 100-year floodplain and one option that would place them within the Zone X500 floodplain. However, it is likely that the optional locations for the reagent storage structure and one of the cooling tower options would actually be on land that is outside of the 100-year floodplain as the elevation of the area (approximately 582 to 586 feet amsl [AEP, 2002]) would be above the level of the 1980 base flood elevation (582 feet amsl), possibly within Zone X500 floodplain. The easternmost option for the proposed cooling tower would likely still be located in the 100-year floodplain as the elevation of that area (mostly in the 581.5 feet amsl range [AEP, 2002]) would be below the level of the 1980 base flood elevation. As a mitigation measure, AEP could select the westernmost options for both of these features, which would ensure they are placed outside the mapped 100-year floodplain, but within the Zone X500 floodplain.

The Refrigeration Area (covering approximately 22,400 square feet of land area) would be located almost entirely within the mapped 100-year floodplain. In addition, a small portion of the northern corner of the Electric/Control Room/Lab Building would be located within the mapped 100-year floodplain. Considering the current elevation of these areas (approximately 587 feet amsl [AEP, 2002], 5 feet above the level of the 1980 base flood elevation [582 feet amsl]) it is likely that they would actually be located outside of 100-year floodplain, possibly within Zone X500 floodplain.

Ultimately, should the easternmost option for the cooling tower be constructed within the 100-year floodplain, it would be designed such that the lowest floor is either elevated to or above the base flood elevation or flood-proofed below the level of the base flood elevation in order to comply with the Mason County Floodplain Ordinance. Unless a FIS is conducted in the area that shows the potential structure would be outside of the 100-year floodplain, this would be a requirement of the floodplain ordinance, which identifies the 1980 FIRMs as the guide to 100-year floodplain locations. Any other structures that would potentially be constructed within 100-year floodplain would already be elevated above the base flood elevation by the fill material brought to the site for development of the Mountaineer Plant.

The presence of structures in the floodplain, particularly the 100-year floodplain, which is the target of floodplain regulation, would have the potential to cause obstructions that could increase flood elevations upstream and redirect flood flows. However, considering that the Ohio River is a major waterway (the river is approximately 1,000 to 1,200 feet wide near the project site, while the 100-year floodplain covers approximately an additional 1,400 to 1,600 feet in width of land adjacent to the river banks) and the project features would represent relatively small obstructions, it is not anticipated that the presence of these new facilities would alter the floodplain or redirect flood flows in a manner that would endanger human safety, property, or the environment or cause a measurable increase in flood elevations. Impacts to the 100-year floodplain could be minimized by choosing the westernmost options for the cooling tower and reagent storage structures. In addition, by complying with the Mason County Floodplain Ordinance design standards, the safety of workers at the facility would be protected. Therefore, overall, minor long-term direct impacts to floodplains would be expected.

Pipeline Corridors

Wetlands

Table 3.7-10 presents the areas of wetlands that would be contained within the permanent ROWs of the pipeline routes. The majority of impacts to wetlands would result from the construction activities already described. Within riverine wetlands, following construction, the banks and bottom contours of features would be restored to their preexisting conditions to the extent practicable; therefore, no long-term or permanent impacts to these features would occur.

Within palustrine wetlands, localized permanent impacts would consist of wetland type conversions as described for construction activities but within the permanent ROWs (approximately 50 feet wide). The potential for conversion would occur due to the continual clearing of woody vegetation within the permanent ROWs, which does not involve the removal of below ground biomass (i.e., roots) or disturbance of soil below the surface. Maintaining the ROWs free of woody vegetation is necessary to preserve access to the ROWs for pipeline inspection and maintenance activities. Initially, wetlands would be converted from one vegetative class into another in forested palustrine wetlands, though emergent wetlands with herbaceous vegetation would generally be maintained in their present state, as herbaceous vegetation would likely be able to persist to some degree. However, continual mowing of the ROWs would limit the sizes to which plants could grow and could make these areas unsuitable for some existing species. Consequently, within all affected palustrine wetlands, the types and magnitude of wetland functions would change. Typical examples of changed wetland functions could include alterations to wildlife habitat, flood flow attenuation, and sediment stabilization and retention functions. These changes can be considered a diminishing of wetland value in some respects (e.g., converting a forested wetland to grassland may reduce an area’s long term ability to absorb water after a flood event); however, they can also increase wetland value in some respects (e.g., providing habitat for grassland or forest edge wildlife, such as grassland birds and many bat species). Overall, minor direct permanent impacts to palustrine wetlands would be expected as relatively small amounts of wetland areas would be affected (2.59 acres each for the Borrow Area Route, Eastern Sporn Routes 1 and 3, and the Western Sporn Route; 2.70 acres each for Eastern Sporn Routes 2 and 4 and Jordan Routes 1 through 4).

There would be no filling of wetland areas; however, the movement of vehicles and heavier equipment (e.g., backhoes) through palustrine wetlands during pipeline maintenance activities (e.g., replacing a pipe) could cause compaction of wetland soils in some locations, which could cause a minor direct impact of altering wetland hydrology. To the extent practicable, AEP would avoid having vehicles or heavier equipment traverse palustrine wetlands; however, it is possible that it may be a necessity in some locations. To the extent practicable, no vehicles or heavier equipment would be allowed to traverse riverine wetlands because of the need to maintain the bed and bank morphologies of these features. In the event that a pipeline in a wetland required maintenance that necessitated excavation to expose the pipe, the impacts would be the same as those described under Section 3.7.3.1.

Table 3.7-10. Wetland Areas within Pipeline Permanent ROWs

Potential Injection Well Property	Pipeline Route Options	Permanent Operational Disturbance (acres)							Resource Impact Rating
		Palustrine / Scrub-Shrub / Broad-Leaved Deciduous	Palustrine / Emergent / Persistent Emergent	Riverine / Upper Perennial	Riverine / Lower Perennial	Riverine / Intermittent	Riverine / Ephemeral	Total Wetland Disturbance	
Mountaineer Plant	Plant Routing	0	0	0	0	0	0	0	Negligible
Borrow Area	Borrow Area Route	2.05	0.54	0	0.02	0.01	0.01	2.63	Minor
Eastern Sporn Tract	Eastern Sporn Route 1	2.05	0.54	<0.01	0.04	0.05	0.02	2.71	Minor
	Eastern Sporn Route 2	2.05	0.65	0.02	0.05	0.09	0.04	2.90	Minor
	Eastern Sporn Route 3	2.05	0.54	0	0.04	0.06	0.02	2.71	Minor
	Eastern Sporn Route 4	2.05	0.65	0.02	0.06	0.09	0.05	2.92	Minor
Jordan Tract	Jordan Route 1	2.05	0.65	0.01	0.10	0.11	0.05	2.97	Minor
	Jordan Route 2	2.05	0.65	0.01	0.07	0.09	0.06	2.93	Minor
	Jordan Route 3	2.05	0.65	0.01	0.12	0.11	0.05	2.99	Minor
	Jordan Route 4	2.05	0.65	0.01	0.09	0.09	0.07	2.96	Minor
Western Sporn Tract	Western Sporn Route	2.05	0.54	0	0.04	0.12	0.07	2.82	Minor

ROW = right-of-way

Floodplains

As described in Table 3.7-4, the Western Sporn Corridor would be the only pipeline segment that would cross any mapped floodplains. Within its permanent ROW, the Western Sporn Corridor would cross 0.51 acre of 100-year floodplain (Zone A) associated with Broad Run. The pipeline corridor would also cross Broad Run.

Following construction, floodplain, and streambed areas disturbed during pipeline installation would be restored to their original topography to the extent practicable. The only aboveground features that would be in the floodplain would be pipeline location markers, which would not cause any changes to flood elevations or redirect flood flows. Therefore, no impacts to floodplains would occur during operations.

Injection Well Sites

Wetlands

Each injection well site would include a pipeline spur, a 0.5-acre injection well site operational area, and an access road. These features are discussed below. Table 3.7-11 presents the areas of wetlands that would be contained within the permanent ROWs of the pipeline spurs. The only pipeline spurs that could affect wetlands are those associated with the Eastern Sporn Tract. Each potentially affected wetland type would be riverine and would produce similar impacts to those described above for the pipeline corridors.

The majority of impacts to wetlands would result from construction activities already described. Within riverine wetlands, following construction, the banks and bottom contours of features would be restored to their preexisting conditions to the extent practicable. Therefore, no long-term or permanent impacts to these features would occur. Also, relatively small areas of wetlands would be included in the permanent ROWs; the greatest amount would be within the spur to ES-2 from the Eastern Sporn Corridor (0.019 acre). To the extent practicable, no vehicles or heavier equipment (e.g., backhoes) would be allowed to traverse riverine wetlands because of the need to maintain the bed and bank morphologies of these features. In the event that a pipeline in a wetland required maintenance that necessitated excavation to expose the pipe, the impacts would be the same as those described for construction, though this is considered unlikely.

No filling of wetlands is proposed for development of the pipeline spurs; therefore, no USACE permit to fill wetland areas would be required. Prior to construction, AEP would be responsible for obtaining a USACE Nationwide Permit 12, “Utility Line Activities,” or an Individual Permit from the Huntington District for authorization to construct the pipelines through wetland areas considered waters of the U.S.

Table 3.7-12 summarizes impacts by wetland type for well operations. The table presents the areas of wetlands that could require filling within the well pad areas.

The only injection well property where well operation activities would affect wetlands would be at Eastern Sporn Tract for Injection Well Site option ES-1. However, the potentially affected wetland feature consists of a very small proportion of the well pad area (<0.001 acre); thus, the final siting of this option could be adjusted to avoid impact to the wetland if practicable. Otherwise, this relatively small wetland area would have to be filled; thus, removing it from existence altogether and requiring a permit from the USACE Huntington District.

Should any additional well locations be developed at any of the properties, one of AEP’s siting criteria (see Section 2.3.1) would be to avoid placing them within any wetland areas. Therefore, development of any additional well locations would not be expected to cause any impacts.

Table 3.7-11. Pipeline Spur Operational Impacts to Wetlands

Potential Injection Well Property	Final Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Permanent Operational Disturbance (acres)			Resource Impact Rating
			Riverine / Ephemeral	Riverine / Intermittent	Total Wetland Disturbance	
Mountaineer Plant	NA	NA	0	0	0	Negligible
Borrow Area	North Segment B	Spur to BA-1	0	0	0	Negligible
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1	0.001	0	0.001	Minor
		Spur to ES-2	0	0.006	0.006	Minor
		Spur to ES-3	0.002	0.005	0.007	Minor
	Eastern Sporn Corridor	Spur to ES-1	0.002	0.005	0.007	Minor
		Spur to ES-2	0.007	0.012	0.019	Minor
		Spur to ES-3	0.004	0.007	0.011	Minor
Jordan Tract	Jordan West Corridor	Spur to JT-1	0	0	0	Negligible
	Jordan East Corridor	Spur to JT-1	0	0	0	Negligible
Western Sporn Tract	Foglesong Corridor	Spur to WS-1	0	0	0	Negligible

NA = not applicable; ROW = right-of-way

Table 3.7-12. Injection Well Site Operational Impacts to Wetlands

Potential Injection Well Property	Injection Well Site Option	Permanent Operational Disturbance (acres)	Resource Impact Rating
		Riverine / Ephemeral	
Mountaineer Plant	MT-1	0	Negligible
Borrow Area	BA-1	0	Negligible
Eastern Sporn Tract	ES-1	<0.001	Minor
	ES-2	0	Negligible
	ES-3	0	Negligible
Jordan Tract	JT-1	0	Negligible
Western Sporn Tract	WS-1	0	Negligible

Table 3.7-13 summarizes the impacts by wetland type for access road operation. The table presents the areas of wetlands that could require filling within the access road permanent ROWs, although the placement of the access road to ES-2, if selected, would be adjusted to avoid the wetland area.

The only injection well access road that would potentially affect wetland areas would be associated with Injection Well Site ES-2, which would include 0.001 acre within the permanent ROW. However, the potentially affected wetland feature consists of a very small proportion of the permanent ROW area (0.001 acre). Thus, the final siting of this access road would be adjusted so as not to impact the wetland if practicable. Otherwise, this relatively small wetland area would have to be filled; thus, removing it from existence altogether and requiring a permit from the USACE Huntington District.

Monitoring wells would be used to evaluate groundwater quality in the overlying groundwater aquifers and to monitor the CO_2 plume within the target formations. Each monitoring well would be expected to require 0.5 acre during operations. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. The quantity and location of the monitoring wells would be determined during the UIC permitting process and based in part on the results of the geologic characterization study. AEP would, to the greatest extent practicable, use the siting criteria presented in Section 2.3.1. Based on these criteria, it is expected that AEP would avoid wetlands, streams, floodplains, and sensitive habitats. Impacts from the operation of the monitoring wells would be similar to those discussed for the injection wells.

Table 3.7-13. Potential Injection Well Site Access Road Operational Impacts to Wetlands

Potential Injection Well Property	Final Pipeline Segment Option	Injection Well Site Option	Permanent Operational Disturbance (acres)	Resource Impact Rating
			Riverine / Ephemeral	
Mountaineer Plant	NA	MT-1	0	Negligible
Borrow Area	North Segment B	BA-1	0	Negligible
Eastern Sporn Tract	Blessing Road Segment B	ES-1	0	Negligible
		ES-2	0.001	Negligible
		ES-3	0	Negligible
	Eastern Sporn Corridor	ES-1	0	Negligible
		ES-2	0.001	Negligible
		ES-3	0	Negligible
Jordan Tract	Jordan West Corridor	JT-1	0	Negligible
	Jordan East Corridor	JT-1	0	Negligible
Western Sporn Tract	Foglesong Corridor	WS-1	0	Negligible

NA = not applicable; ROW = right-of-way

Floodplains

As described in Table 3.7-5, the only injection well properties that contain any floodplains are the Eastern Sporn and Western Sporn Tracts. No impacts would be expected during operations at the Eastern Sporn Tract as the Injection Well Sites (ES-1, ES-2, and ES-3) are a minimum of 0.5 mile from the nearest floodplain area, and AEP's siting criteria for any other injection well sites (see Section 2.3.1) would include avoiding floodplain areas.

At the Western Sporn Tract, Injection Well Site WS-1 is located approximately 100 feet from the boundary of a Zone A floodplain area and generally up-gradient (0 to 40 feet). Therefore, land disturbing activities during well operations and maintenance (e.g., vehicle movements and equipment replacement) could cause sedimentation to the floodplain area via wind and water erosion. Minimal amounts of sedimentation would occur and it is not expected that sediments would be eroded at a level that would cause any increase in flood elevations or redirect flood flows. Therefore, negligible indirect impacts would result.

An unknown number of monitoring wells would be used to evaluate groundwater quality in the overlying groundwater aquifers and to monitor the CO_2 plume within the target formations. Each monitoring well would be expected to require 0.5 acre during operations. Impacts to wetlands and floodplains from the operation of the monitoring wells would be similar to those discussed for the injection wells.

3.7.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to wetlands and floodplains.

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3.8 BIOLOGICAL RESOURCES

3.8.1 Introduction

This section identifies and describes the biological resources potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources.

3.8.1.1 Region of Influence

The ROI for biological resources includes the Mountaineer Plant property, pipeline corridors, and injection well sites. The ROI includes surface waters that would be crossed by pipeline corridors or would be influenced by construction or operation of the project. In the following discussion, these areas are collectively referred to as the "study area." Disturbances to biological resources outside of the ROI are not expected.

3.8.1.2 Method of Analysis

DOE reviewed a number of references to obtain information on the types of aquatic and terrestrial habitats and biota affected by the project, including: consultation with USFWS and WVDNR; review of available lists and databases of protected species and habitats; West Virginia National Biological Information Infrastructure Gap Analysis Program landcover data; USDA land cover data; NatureServe Explorer Ecological System records; the NRCS Mason County Field Office Technical Guide; and invasive species databases, including the Early Detection & Distribution Mapping System developed by the University of Georgia - Center for Invasive Species and Ecosystem Health. In addition, DOE made observations of ecological conditions within the study area during the 2010 summer field season. This information was used to provide a holistic view of the potentially affected environment in terms of the vegetative and aquatic communities, species, and habitats present.

Quantitative estimates of potential impacts were calculated using GIS and land cover data. Qualitative assessments were made based on the potential effects to species and habitats from expected attributes of the project.

3.8.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to biological resources based on whether the Mountaineer CCS II Project would directly or indirectly

- cause substantial loss of vegetation communities and distribution of vegetation within the ROI (e.g., unique communities not in regional abundance, tracts of non-fragmented forested habitat);
- cause a decline in native wildlife populations;
- promote the spread of invasive, non-native species;
- degrade biological habitat or interfere with the movement of native or migratory terrestrial or aquatic species;
- encroach on or degrade critical or protected habitat for impact-sensitive, threatened, or endangered species;
- violate federal or related state regulations, including the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act, and EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds*;*
- conflict with applicable management plans for wildlife and/or wildlife habitat, including aquatic communities;

- alter drainage patterns and fish species movement;
- diminish the value of habitat for fish species and native fish populations;
- cause loss of wetland habitat; or
- indirectly affect biological resources (e.g., noise, population fragmentation, traffic).

3.8.2 Affected Environment

The following provides a general description of terrestrial and aquatic habitats, typical species present, and the potential for protected species within the study area. Sections 3.8.2.2, 3.8.2.3, and 3.8.2.4 provide more detailed descriptions of these resources within the Mountaineer Plant property, pipeline corridors, and injection well properties, respectively.

3.8.2.1 Terrestrial Vegetation and Habitats

The study area is located within the Western Allegheny Plateau ecoregion which covers portions of eastern Ohio, southwestern Pennsylvania, northwestern West Virginia, and a small part of northeastern Kentucky. The ecoregion covers approximately 32,630 square miles and is about 72 percent forest and 23 percent agriculture. The forest area is mostly mixed oak and mixed temperate forests that still exist today on most of the remaining rounded hills (USGS, 2010f).

The U.S. National Vegetation Classification System and land cover data were used to further characterize the terrestrial vegetation communities and habitats within the study area. This system was developed by The Nature Conservancy and NatureServe in collaboration with partners from the academic, conservation, and government sectors. This system provides consistent classification on a scale fine enough to be useful for the conservation of specific sites and has been adopted by the Federal Geographic Data Committee for use by all U.S. federal agencies.

The study area supports three broad categories (or systems) of vegetation communities: natural systems (e.g., forested, riparian/floodplain), human altered/disturbed systems (i.e., agricultural and developed land), and previously disturbed systems (i.e., utility ROW) (see Figure 3.8-1). Vegetation communities within each of the three systems are described below.

DOE also used 2008 soil survey data and recent aerial photography (2009) for the following: (1) identify previously disturbed areas; (2) identify urban/disturbed soils (also see Section 3.4, Physiography and Soils); and (3) delineate the existing utility ROWs.

The following text provides a description of typical vegetation and habitat associated with these three broad systems, including each system's associated vegetation communities based on the U.S. National Vegetation Classification System (NatureServe, 2010). The distribution percentage of these systems within the study area is presented in Sections 3.8.2.2 through 3.8.2.4:

Natural Systems

- **Appalachian Hemlock-Hardwood Forest** – This system is a mesic (moist) to dry-mesic mixed forest, with stands containing some amount (greater than 25 percent) of eastern hemlock (*Tsuga canadensis*). Northern hardwoods such as sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) are characteristic, either forming a deciduous canopy or mixed with eastern hemlock (or in some cases white pine [*Pinus strobus*]). Other common and sometimes dominant trees include oaks (*Quercus* spp.), tuliptree (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), and sweet birch (*Betula lenta*).

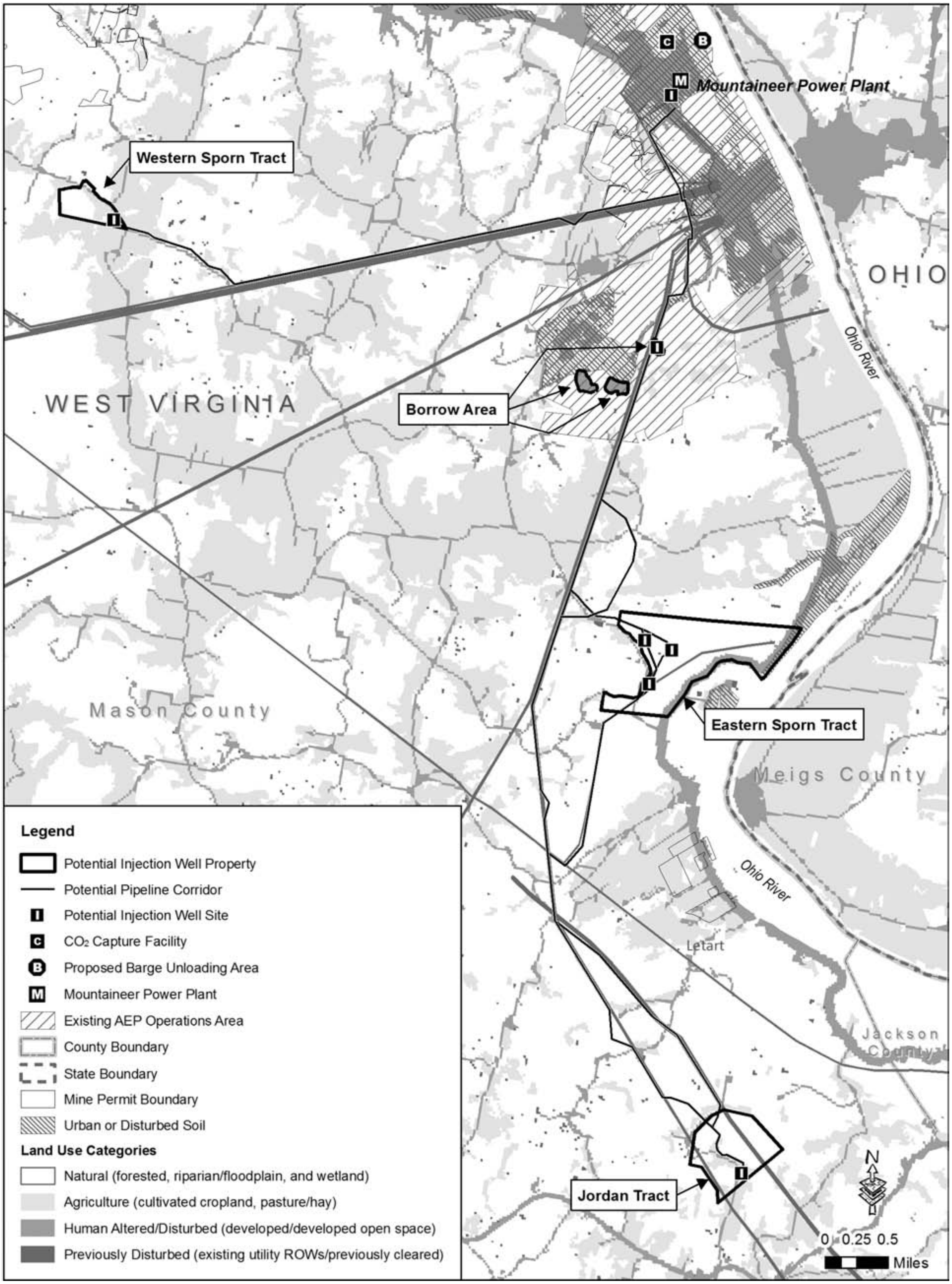

Figure 3.8-1. Land Cover within the Study Area

- **Allegheny-Cumberland Dry Oak Forest and Woodland** – This system includes dry hardwood forests on predominately acidic substrates. These forests are typically dominated by white oak (*Quercus alba*), southern red oak (*Quercus falcate*), chestnut oak (*Quercus prinus*), scarlet oak (*Quercus coccinea*), with lesser amounts of red maple (*Acer rubrum*), pignut hickory (*Carya glabra*), and mockernut hickory (*Carya alba*).
- **Central Interior and Appalachian Floodplain Systems** – This system includes forests found along medium to large river floodplains. Characteristic trees include silver maple (*Acer saccharinum*), eastern cottonwood (*Populus deltoids*), river birch (*Betula nigra*), sugarberry (*Celtis laevigata),* sweetgum (*Liquidambar styraciflua*), willows (*Salix spp.*), and sycamore (*Platanus occidentalis*), with green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus Americana*), tuliptree, and bur oak (*Quercus macrocarpa*) in more well-drained areas.
- **Central Interior and Appalachian Riparian Systems** – This system includes forests found on moderately to very high-gradient smaller rivers, creeks, and streams over a wide range of elevations. This system develops on small floodplains and shores along river channels that lack a broad, flat floodplain due to steeper sideslopes, higher gradient, or both. Common trees include river birch, sycamore, and box elder (*Acer negundo*). Where somewhat more stable, linear forests develop; typical trees include tuliptree, sweetgum, red maple, sugarberry, and green ash.
- **Central Interior and Appalachian Swamp Systems –** This system is characterized by wetland areas located in basins. Typical species include red maple, alder (*Alnus spp.),* sedges (*Carex spp*.), common buttonbush (*Cephalanthus occidentalis*), black ash (*Fraxinus nigra*), holly (*Ilex spp*.), blackgum (*Nyssa sylvatica*), cinnamon fern (*Osmunda cinnamomea*), swamp white oak (*Quercus bicolor*), and pin oak (*Quercus palustris*).
- **Northeastern Interior Dry-Mesic Oak Forest** – This system consists of oak-dominated forest occurring in dry-mesic settings covering large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. Soils are mostly acidic and relatively infertile. Oak species characteristic of dry-mesic conditions (e.g., red oak [*Quercus rubra*], white oak [*Quercus alba*], black oak [*Quercus velutina*], scarlet oak [*Quercus coccinea*], and hickory [*Carya spp.*]) are dominant in mature stands. Pin oak may be present, but is generally less important than the other oak species. Red maple, sweet birch, and yellow birch may be common associates. Due to historic cutting(s), many of these forests are in early- to mid-successional stages, where white pine, Virginia pine, or tuliptree may be dominant or codominant. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands, including non-forested seeps or forested wetlands with red maple, swamp white oak, or blackgum.
- **South-Central Interior Mesophytic Forest** – This system consists of deciduous forests with high species diversity. It occurs on deep and enriched soils in non-montane settings and usually in somewhat protected landscape positions, such as coves or lower slopes. Dominant species include silver maple, American beech, tuliptree, basswood (*Tilia Americana*), red oak, cucumbertree (*Magnolia acuminate*), and black walnut (*Juglans nigra*). The herbaceous layer is very rich, often with abundant spring ephemerals. Many examples may be bisected by small streams.

The natural vegetation communities described above provide the greatest amount of wildlife habitat diversity due to the lower amounts of human disturbance and higher diversity of native plant species. As a result, these areas would be anticipated to support the greatest biological diversity. Sections 3.8.2.2 through 3.8.2.4 contain lists of wildlife observed during the 2010 field season within each portion of the study area. The above descriptions include reference to wetland- and floodplain-influenced systems; please refer to Section 3.7, Wetlands and Floodplains, for analysis.

Human Altered/Disturbed Systems

- **Cultivated Cropland** – This system contains areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards.
- **Developed, Low Intensity** – This system includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-50 percent of total cover. These areas most commonly include single-family housing units.
- **Developed, Medium Intensity** – This system includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-80 percent of the total cover. These areas most commonly include single-family housing units.
- **Developed, Open Space** – This system includes vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20 percent of total cover. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
- **Pasture/Hay** – This system includes agricultural lands that typically have perennial herbaceous cover (e.g. regularly-shaped plantings) used for livestock grazing or the production of hay. There are obvious signs of management, such as irrigation and haying, that distinguish these areas from natural grasslands.

Human altered/disturbed systems typically have elevated levels of invasive and non-native (exotic) plant species. Not all exotic species are invasive; the more prone an exotic species is to spreading and proliferation over native species, the more invasive an exotic species is considered. EO 13112, *Invasive Species*, requires federal agencies, to the extent practicable and permitted by law, to prevent the introduction of invasive species; to provide for their control; and to minimize the economic, ecological, and human health impacts that invasive species cause.

EO 13112, *Invasive Species* defines invasive species as a species that is: 1) non-native (exotic) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

According to the Early Detection & Distribution Mapping System database, 104 exotic plant species have been recorded in Mason County, West Virginia (University of Georgia, 2010). Table 3.8-1 lists the exotic plant species observed within the study area during the 2010 field season and provides general characteristics of these species (PHE, 2010).

Table 3.8-1. Exotic Plant Species Identified within the Study Area

Common Name	Latin Name	Characteristics
Autumn olive	*Eleagnus umbellate*	Autumn olive is a deciduous shrub from 3-20 feet in height and invades old fields, woodland edges, and other disturbed areas. It can form a dense shrub layer which displaces native species and closes open areas. It has been widely planted for wildlife habitat, mine reclamation, and shelterbelts.
Garlic mustard	*Alliaria petiolata*	Garlic mustard is an herbaceous, biennial forb (herbaceous flowing plant) that is an aggressive invader of wooded areas throughout the eastern and middle U.S. A high shade tolerance allows this plant to invade high-quality, mature woodlands, where it can form dense stands. These stands not only shade out native understory flora, but also produce allelopathic compounds (i.e., compounds that inhibit seed germination of other species).

Table 3.8-1. Exotic Plant Species Identified within the Study Area

Common Name	Latin Name	Characteristics
Japanese honeysuckle	*Lonicera japonica*	Japanese honeysuckle is an evergreen to semi-evergreen vine that can be found either trailing or climbing to over 80 feet in length and invades a variety of habitats including forest floors, canopies, roadsides, wetlands, and disturbed areas. Japanese honeysuckle can girdle small saplings by twining around them, and it can form dense mats in the canopies of trees, shading everything below. It has been planted widely throughout the U.S. as an ornamental, for erosion control, and for wildlife habitat.
Japanese knotweed	*Fallopia japonica*	Japanese knotweed is a dense-growing shrub reaching heights of 10 feet and commonly invades disturbed areas with high light, such as roadsides and stream banks. Reproduction occurs both vegetatively (rhizomes) and by seeds, making this plant extremely hard to eradicate. The dense patches shade and displace other plant life and reduce wildlife habitat.
Multiflora rose	*Rosa multiflora*	Multiflora rose is a multi-stemmed, thorny, perennial shrub that grows up to 15 feet tall and forms impenetrable thickets in pastures, fields, and forest edges. It restricts human, livestock, and wildlife movement and displaces native vegetation. Multiflora rose is native to Asia and was first introduced to North America in 1866 as rootstock for ornamental roses. During the mid-1900s, it was widely planted as a "living fence" for livestock control.

Source: Invasive Plant Atlas of the United States, 2010

Note: These species were recorded during an overall characterization of vegetation within the study area. No detailed surveys were conducted regarding the identification, location and distribution of invasive species within the study area.

Compared to natural systems, human altered/disturbed systems (i.e., agricultural land and developed areas) support less wildlife diversity. Wildlife typically found within these areas are species adjusted to human disturbance, including raccoons (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), striped skunks (*Mephitis mephitis*), coyote (*Canis latrans*), fox (*Vulpes vulpes*), turkey (*Meleagris gallopavo*) and various rodents (*Rodenta* family) such as mice, shrew and squirrels. These areas typically have fragmented or open grassland habitat, which is favorable for the mammal species mentioned above. The quality of bird species habitat with human altered/disturbed systems, such as developed portions within the Mountaineer Plant property, is also generally considered less than that of natural systems. Many invasive bird species, such as rock pigeon (*Columba livia*) and European starling (*Sturnus vulgaris*), use this type of land. There are a few native grassland species that use croplands, such as horned lark (*Eremophila alpestris*) and American crow (*Corvus brachyrhynchos*). Farmed areas offer less habitat options in terms of stopover habitat for migratory birds, however, they do provide forage during migration and winter to some species (e.g., American pipit [*Anthus rubescens*] and snow bunting [*Plectrophenax nivalis*]).

Previously Disturbed Systems

- **Ruderal Wetland and Forest** – This system consists of early successional vegetation resulting from large-scale, human-caused disturbance (i.e., clearing, grading, etc) of an area. It is generally characterized by unnatural combinations of species, including both native and non-native species to varying degrees.
- **Ruderal Early Successional Grassland and Scrub/Shrub** – This system is not part of the NatureServe ecological land cover types; it was developed during this EIS analysis to categorize the existing utility ROWs that occur within the study area. Similar to the ruderal wetland and forest system, ROW areas have experienced previous and ongoing vegetation control which involves a combination of clearing and herbicide. Clearing activities generally occur at least once every 4 years, but may be more frequent if necessary to maintain the reliability and performance of the line. Between clearing periods, early successional communities, including grassland and

scrub/shrub, become established within the ROWs. Due to past disturbance, these areas are generally characterized by a combination of native species with areas of persistent exotic species. The early successional state of vegetation, along with the presence of exotic species, typically lowers the overall quality of habitat when compared to forested areas or natural open meadows.

Compared to ongoing human altered/disturbed systems (i.e., agricultural land and developed areas), previously disturbed systems (including ROW areas) support a greater diversity of wildlife.

Aquatic Habitats

Section 3.6, Surface Water, discusses the surface waters and water quality of streams that potentially support aquatic resources within the study area. As discussed in Section 3.6, with the exception of the Ohio River (the main receiving waterbody), the tributary watersheds within the study area are typified by moderate to low-gradient streams. The only surface water feature listed as impaired in the vicinity of the study area is the Ohio River (i.e., due to nonpoint source pollution from urban runoff, agricultural activities, and abandoned mines). Other perennial surface water resources within the study area include Brinker Run, Broad Run, Claylick Run, Little Broad Run, Mud Run, Thombleson Run, Tenmile Creek, and West Creek. None of these surface waters is recognized as a "high quality water," "outstanding national resource water," or "trout water" (47 CSR 2).

Common aquatic life within the Ohio River includes typical warmwater big river fish species, such as black bullhead (*Ameiurus melas*), channel catfish (*Ictalurus punctatus*), skipjack herring (*Alosa chrysochloris*) and gizzard shad (*Dorosoma cepedianum*). Populations of fish species less tolerant to pollution, such as mooneye (*Hiodon tergisus*), stonecat (*Noturus flavus*), largemouth bass (*Micropterus salmoides*) and spotted bass (*Micropterus punctulatus*), which prefer clear water or clear water with aquatic vegetation, have increased with improving water quality of the Ohio River (EPRI, 2009).

Over 130 species of mussels have been reported in the Ohio River System. Within the portion of the Ohio River bordering West Virginia, approximately 35 freshwater mussel species (5 endangered) and a variety of other macroinvertebrate have been documented. Specifically within the study area, AEP conducted a mussel survey in 2005 between Ohio River river miles 242.3 and 243.1 located along the existing Mountaineer Plant riverfront. The survey was conducted as part of an AEP proposal for mooring (with applicable dredging activities) a new barge unloading facility (Enviroscience, 2005). The survey identified a total of 60 live unionids (freshwater mussels in the order *Unionoida*) representing 8 species, collected within the study. An additional five species were collected only as weathered dead shells. The Threehorn wartyback (*Obliquaria reflexa*) was the most abundant species (56.7 percent), followed by the threeridge (*Amblema plicata*) and the black sandshell (*Ligumia recta*) (16.7 and 15.0 percent, respectively). Results of the survey also indicated that Zebra mussels (*Dreissena polymorpha*), a highly invasive aquatic species, were very uncommon. The survey found mussels generally distributed in areas greater than 50 meters from the bank; however, some transects had populations occurring less than 50 meters from the bank (Enviroscience, 2005). No species federally listed as threatened or endangered species were observed; however, there are three species protected under the ESA that may potentially occur in the ROI (see Table 3.8-2).

Common aquatic life found within the perennial streams that are tributaries to the Ohio River include fish species, such as darters (*Etheostoma sp.*) chubs (*Nocomis, Semotilus, and Margariscu spp.)*, stonerollers (*Campostoma anomalum*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and bluntnose minnow (*Pimephales notatus*). Common macroinvertebrate species include isopods, amphipods, and insects. Slow-moving streams such as these are commonly dominated by aquatic insects (including larval and nymph forms), such as the blackfly, burrowing mayfly, caddisfly, and stonefly, and other invertebrates.

The study area also contains numerous intermittent and ephemeral streams. Such "periodic" streams typically provide minimal aquatic habitat. During periods of constant flow within intermittent streams, these streams can support a variety of aquatic macroinvertebrates (e.g., insects and segmented worms). However, species of fish are unlikely to establish populations due the seasonality of water. Amphibian species (e.g., American toad [*Bufo americanus*] and rare species including Jefferson's salamander [*Ambystoma jeffersonianum*], small-mouthed salamander [*Ambystoma texanum*], midland mud salamander [*Pseudotriton montanus diastictus*], and northern red salamander [*Pseudotriton ruber ruber*]) may use these areas and possibly perennial surface waters if they provide suitable breeding habitat and other wildlife, such as bird and mammal species, may use them as sources of water.

Protected Species

The ESA of 1973 provides a program for the conservation of threatened and endangered species and the habitats in which they are found. The ESA regulations prohibit the "take" (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of any listed species, as well as the destruction or modification of its "critical habitat" (i.e., habitat that is essential to the survival of the species).

Coordination letters were sent (June 9, 2010 and August 23, 2010) to both the USFWS and WVDNR regarding any records of occurrence or the potential for occurrence of ESA-protected species and their habitats within the study area. To date, no formal responses to these letters have been received from either agency; however, additional correspondence was conducted with each agency and is described in the following paragraphs. According to the USFWS website, there are three listed endangered species and two candidate species that potentially occur in Mason County (see Table 3.8-2). As previously stated, a mussel survey within the Ohio River was part of a former AEP construction proposal involving dredging activities within the Ohio River, which found no live or dead shells of federally-endangered or -threatened species (Enviroscience, 2005). As the WVDNR has a "no take" policy concerning native mussels, all mussels found during the initial survey were relocated upstream to avoid potential for indirect impacts from that project. Based on the overall moderate to low-gradient, slow-moving, small order streams that occur within the remainder of the study area, it is unlikely that suitable habitat for protected mussel or fish species exists within the study area.

Table 3.8-2. Federally Protected Species Potentially Occurring within the Study Area

Group	Species	Federal Status	Typical Habitat
Mussels	**Pink mucket pearly mussel *(Lampsilis abrupta*)**	Endangered	Typically inhabits medium to large rivers with strong currents, but has also been able to survive and reproduce in areas of impounded reaches. Usually prefers sand and gravel substrate, or pockets between rocky ledges in high velocity areas and mud and sand in slower-moving waters.
Mussels	**Fanshell mussel *(Cyprogenia stegaria irrorata)***	Endangered	Typically inhabits gravel substrate in medium to large rivers of the Ohio River basin.
Mussels	**Clubshell mussel (*Pleurobema clava*)**	Endangered	Typically inhabits small to medium-sized rivers and streams. Choice habitat typically consists of being completely buried in sand/gravel substrates in riffle/run situations in less than 1.5 feet of water.
Mussels	**Sheepnose mussel *(Plethobasus cyphyus)***	Candidate	Typically inhabits shallow shoal habitats with moderate to swift currents over coarse sand and gravel in medium to large rivers.
Fishes	**Diamond darter (*Crystallaria cincotta*)**	Candidate	Found in large rivers with very clear water and extensive sand and gravel bars free of mud and silt. Lives mostly buried in sandy areas.

Source: USFWS, 2010b

Although no known occurrences of the Indiana bat exist for Mason County, the region is on the edge of the range of this species. The bat has been reported in the eastern highlands of West Virginia (WVDNR, 2010a). Indiana bats hibernate during the winter months in caves and abandoned mines. During their active season, Indiana bats typically occur in wooded areas, roosting under loose tree bark and foraging for insects along the edges of forested areas and streams (WVDNR, 2010a). Mist net and habitat surveys for Indiana Bats in the study area were performed during the summer of 2010 in accordance with a study plan submitted to the USFWS service on June 9, 2010 (see Appendix F), and subsequently approved of by the agency on June 28, 2010. No evidence of Indiana bats was found as a result of this study. Furthermore, in a letter dated November 15, 2010, the USFWS concurred with findings of the study and concluded that no federally-listed endangered and threatened bats are expected to be impacted by the proposed project (see Concurrence Form for Indiana Bat Mist Net Reports in Appendix C). The final bat survey report can be found in Appendix F.

USFWS's November 15, 2010 concurrence letter also stated that the Project is not likely to adversely affect ESA-protected species and no further consultation with USFWS under the ESA is required. In addition, e-mail correspondence with WVDNR dated February 10, 2011, stated that WVDNR is satisfied with the Project if all requirements and concerns of USFWS are met (see Appendix C). On January 14, 2011, further consultation was requested of the USFWS as well as WVDNR with respect to the potential for impacts to protected mussel species in the Ohio River resulting from the placement of four H pilings that would be used to support the spud barge associated with upgrades to the existing barge unloading facility. The request letter stated that no adverse impacts would be expected and performing mussel surveys would not be required because the potentially affected area was cleared of mussels during the aforementioned 2005 mussel relocation effort and requested concurrence with this determination. The USFWS and WVDNR responded that the 2005 efforts would continue to be valid through the 2011 field season and additional surveys, and potentially relocation efforts, would be required for any work performed after the 2011 field season.

The MBTA provides protection to migratory birds and their nests and eggs. There are a number of migratory birds that appear in West Virginia and potentially in Mason County, including a number of songbirds, waterfowl, etc. Section 3.8.2.4 contains a list of bird species (including migratory bird species) observed during the 2010 summer field season within the study area.

The Bald and Golden Eagle Protection Act prohibits unauthorized take of Bald and Golden Eagles or their nests. Bald eagles are rare in West Virginia in all seasons. Occasional summer residents are sighted, usually in the vicinity of the Potomac River. During fall migration, bald eagles may be seen all across the state, but most observations come from the mountains where birds follow the ridges southward (WVDNR, 2010b). Golden eagles are rare fall migrants and winter visitors in West Virginia. There is no definite evidence that they have ever nested in the state, but there have been occasional summer sightings in recent years. During the winter, golden eagles are seen primarily in the mountain counties from Tucker County south to Monroe County (WVDNR, 2010b).

3.8.2.2 CO_2 Capture Facility

The area for the proposed CO_2 capture facility includes approximately 33 acres within the existing Mountaineer Plant property. This site has been previously disturbed (i.e., cleared and graded) and consists of a human altered/disturbed system vegetation community (developed, open space industrial land cover; i.e., grassy areas, see Figure 3.8-2). The existing level of disturbance and high level of human activity within and adjacent to the proposed site provides poor habitat quality for most wildlife species, with the exception of those species adapted to high levels of human activity and disturbance (e.g., rodents, starlings, etc.). The potential for the occurrence of protected species is unlikely.

Figure 3.8-2. Proposed CO_2 Capture Facility Site

3.8.2.3 Pipeline Corridors

The overall existing baseline conditions of the potential pipeline corridor is previously cleared high voltage transmission line (HVTL) ROW (ruderal early successional grassland and scrub/shrub), which is maintained periodically (a minimum of at least once every 4 years) using a combination of vegetative clearing and herbicide (see Table 3.8-3 and Figures 3.8-3 and 3.8-4). Table 3.8-3 identifies the approximate percentage of each vegetation community within the pipeline corridors, by segment (refer to Figure 2-7 for the location of each segment); bolded and gray-shaded values in the table indicate the dominant vegetation community within each pipeline segment. Overall, as indicated in Table 3.8-3, the dominant vegetation community within the proposed pipeline corridors is Ruderal Early Successional Grassland and Scrub/Shrub. This community's dominance is due to the prior and ongoing disturbance of the existing HVTL ROW located within the pipeline corridors. Pasture/Hay and South-Central Interior Mesophytic Forest are also common in the pipeline corridors. A specific discussion of surface water resources and wetland resources within the pipeline corridors is presented in Section 3.6, Surface Water, and Section 3.7, Wetlands and Floodplains.

The pipeline corridors would cross surface water features, including perennial, intermittent, and ephemeral streams, including those within the existing transmission ROW (see Table 3.6-6 in Surface Water). Section 3.7 discusses the occurrence of wetlands within the pipeline corridors. Most of these crossings would occur within existing ROW areas; thus, water quality is likely to be somewhat degraded. Streams within existing ROW areas lack riparian cover and have a relatively slow velocity of stream flow. Generally streams with these characteristics have low levels of dissolved oxygen, which would reduce the diversity of aquatic species within these stream segments. Figures 3.8-5 and 3.8-6 show typical aquatic habitat conditions of perennial streams within the existing ROWs of the pipeline corridors (see Section 3.6, Surface Water, and Section 3.7, Wetlands and Floodplains, regarding discussions of intermittent and ephemeral streams).

Table 3.8-3. Vegetation Communities within the Potential Pipeline Segments

Potential Pipeline Segment	Vegetation Community (Percentage by Potential Pipeline Segment)													
	Natural (Forested, Riparian/ Floodplain, and Wetland)							***Human Altered/Disturbed***					***Previously Disturbed***	
								Agriculture		**Developed**				
	Appalachian Hemlock-Hardwood Forest	Allegheny-Cumberland Dry Oak Forest and Woodland	Central Interior and Appalachian Floodplain Systems	Central Interior and Appalachian Riparian Systems	Central Interior and Appalachian Swamp Systems	Northeastern Interior Dry-Mesic Oak Forest	South-Central Interior Mesophytic Forest	Cultivated Cropland	Pasture/Hay	Developed, Low Intensity	Developed, Medium Intensity	Developed, Open Space	Ruderal Wetland and Forest	Ruderal Early Successional Grassland and Scrub/Shrub
North Segment A			7		9	2	7		**43**	8	6	<1		18
North Segment B	5					5	23		4	7		<1	1	**55**
North Segment C														**100**
South Segment A														**100**
South Segment B														**100**
South Segment C														**100**
South Segment D	6					1	2							**91**
South Segment E														**100**
Blessing Road Corridor A	2		9			3	14		**69**			<1		3
Blessing Road Corridor B	29					24	**33**					14		
East Corridor A	22		4			14	16	12	**30**			2		<1
East Corridor B	4					11	8		**63**			12		2
Eastern Sporn Corridor	7					5	34					1		**53**
Jordan West Corridor	9		2			8	25		2			2		**52**
Jordan East Corridor	6		<1			3	12		1			1	3	**73**

Table 3.8-3. Vegetation Communities within the Potential Pipeline Segments

Potential Pipeline Segment	Vegetation Community (Percentage by Potential Pipeline Segment)													
	Natural (Forested, Riparian/ Floodplain, and Wetland)							***Human Altered/Disturbed***					***Previously Disturbed***	
								Agriculture		**Developed**				
	Appalachian Hemlock-Hardwood Forest	Allegheny-Cumberland Dry Oak Forest and Woodland	Central Interior and Appalachian Floodplain Systems	Central Interior and Appalachian Riparian Systems	Central Interior and Appalachian Swamp Systems	Northeastern Interior Dry-Mesic Oak Forest	South-Central Interior Mesophytic Forest	Cultivated Cropland	Pasture/Hay	Developed, Low Intensity	Developed, Medium Intensity	Developed, Open Space	Ruderal Wetland and Forest	Ruderal Early Successional Grassland and Scrub/Shrub
Western Sporn Corridor	2		<1	<1		2	7	1	8	<1		1	<1	**78**
Foglesong Corridor	8		2	<1		6	33	6	**39**			5		<1

Note: Gray-shaded cells in the table identify vegetation communities NOT present within the potential pipeline corridor segment. Bold numbers identify the dominant vegetation community within each segment.

Figure 3.8-3. Previously Disturbed Vegetation Community Occupying Existing ROW along the South Pipeline Corridor – Segment D

Figure 3.8-4. Typical Previously Disturbed Vegetation Community Occupying Existing ROW along the Western Sporn Corridor

Figure 3.8-5. Perennial Stream Tributary to West Creek, South Corridor - Segment C

Figure 3.8-6. Little Broad Run at the East End of Western Sporn Corridor

Based on the current conditions and characteristics of streams within the pipeline corridors, it is unlikely that these areas offer suitable habitat for federally protected species that have the potential to occur within the project area (see Table 3.8-2).

3.8.2.4 Injection Well Sites

AEP has identified preferred locations for injection wells based on preliminary environmental screening criteria (see Section 2.3.1). Because the design and selection of the actual injection well sites would be based on the geologic characterization study and findings within this EIS document, this section discusses the biological resources for the entire property of each injection well site. Section 3.8.3 focuses on the potential impacts to biological resources within the preferred injection well site locations at each property (requiring approximately 5 acres for construction and 0.5 acre for operations).

Table 3.8-4 identifies the approximate percentage of each vegetation community within each of the five injection well properties. A discussion of biological resources at property follows.

Mountaineer Plant

The Mountaineer Plant injection well site supports a previously disturbed, Human Altered/Disturbed vegetation community (developed, medium intensity; i.e., a gravel lot) (see Figure 3.8-7). Limited wildlife habitat was present during the field studies. The potential for the occurrence of protected species is unlikely. As stated in Section 3.6, Surface Water, and Section 3.7, Wetlands and Floodplains, no surface water features or wetland habitat occur within this area. Therefore, no aquatic habitat or resources are present, including no potential habitat for protected species.

Table 3.8-4. Vegetation Communities within the Potential Injection Well Properties

Potential Injection Well Property	Vegetation Community (Percentage by Potential Pipeline Segment)													
	Natural (Forested, Riparian/ Floodplain, and Wetland)							*Human Altered/Disturbed*					*Previously Disturbed*	
								Agriculture		Developed				
	Appalachian Hemlock-Hardwood Forest	Allegheny-Cumberland Dry Oak Forest and Woodland	Central Interior and Appalachian Floodplain Systems	Central Interior and Appalachian Riparian Systems	Central Interior and Appalachian Swamp Systems	Northeastern Interior Dry-Mesic Oak Forest	South-Central Interior Mesophytic Forest	Cultivated Cropland	Pasture/Hay	Developed, Low Intensity	Developed, Medium Intensity	Developed, Open Space	Ruderal Wetland and Forest	Ruderal Early Successional Grassland and Scrub/Shrub
Mountaineer Plant											**100**			
Borrow Area											**100**			
Eastern Sporn Tract	23		<1			16	**46**		<1	<1		15	<1	
Jordan Tract	15		2			12	**49**					4		18
Western Sporn Tract	9		12	1		9	**36**					7		26

Note: Gray-shaded cells in the table identify vegetation communities NOT present within the injection well property. Bold numbers identify the dominant vegetation community within each injection well property.

Figure 3.8-7. Potential Mountaineer Plant Injection Well Site

Borrow Area

The Borrow Area site actively supports landfill operations and is classified as a human altered/disturbed system vegetation community. As necessary, the Borrow Area provides clay that is used to develop and close sections of the landfill. The process involves removing the top soil from the Borrow Area and excavating clay as necessary from the site. After the necessary clay is obtained, the top soil is reapplied to the disturbed area, which is then graded and seeded until additional clay is needed. Field observations during the 2010 summer season indicated the property consists of formerly cleared and graded land which has been seeded with grassy vegetation (see Figure 3.8-8). Dominant grassland vegetation included cornflower (*Centaurea cyanus*), white clover (*Trifolium repens*), and red clover (*Trifolium pretense*). Wildlife observed during the field studies included wild turkey (*Meleagris gallopavo*), field sparrow (*Spizella pusilla*), yellow-breasted chat (*Icteria virens*), Eastern towhee (*Pipilo erythrophthalmus*), Baltimore oriole (*Icterus galbula*), grasshopper sparrow (*Ammodramus savannarum*), indigo bunting (*Passerina cyanea)*, American goldfinch (*Spinus tristis*), northern fence lizard (*Sceloporus undulates*), and fritillary and sulphur butterflies (*Agraulis* and *Phoebis spp.)* (PHE, 2010).

As stated in Section 3.6, Surface Water, and Section 3.7, Wetlands and Floodplains, no surface water features or wetland habitat occur within the Borrow Area property. Therefore, no aquatic habitat or resources exist, including no potential habitat for protected species.

Figure 3.8-8. Typical View of the Borrow Area Property (Looking East)

Eastern Sporn Tract

As shown in Table 3.8-4, a majority of the Eastern Sporn Tract is a natural system vegetation community consisting of South-Central Interior Mesophytic Forest (46 percent) (see Figure 3.8-9), Appalachian Hemlock-Hardwood Forest (23 percent), and Northeastern Interior Dry-Mesic Oak Forest (16 percent). Approximately 15 percent of the property consists of a human altered/disturbed vegetation community (developed, open space), primarily due to previous clearing activity and disturbance along Blessing Road and Route 62.

Figure 3.8-9. Dominant South-Central Interior Mesophytic Forest within the Eastern Sporn Tract Injection Well Property, near Center of the Property

Field observations during the 2010 summer season included the following wildlife within this property:

Mammals

- White-tailed deer *(Odocoileus virginianus)*

Birds

- Carolina Chickadee (*Poecile carolinensis*)
- Scarlet Tanager (*Piranga olivacea*)
- Eastern Towhee (*Pipilo erythrophthalmus*)
- Wood Thrush (*Hylocichla mustelina*)
- Blue Jay (*Cyanocitta cristata*)
- **Red-eyed Vireo (*Vireo olivaceus*)**
- White-eyed Vireo (*Vireo griseus*)
- Yellow-billed Cuckoo (*Coccyzus americanus*)
- Acadian Flycatcher (*Empidonax virescens*)
- Eastern Wood Pewee (*Contopus virens*)
- Ovenbird (*Seiurus aurocapillus*)
- Hooded Warbler (*Wilsonia citrine*)
- Worm-eating Warbler *(Helmitheros vermivorus)*
- Common Yellowthroat *(Geothlypis trichas)*
- Mourning Warbler (*Oporornis Philadelphia*)
- Osprey (*Pandion haliaetus*) (over road)
- Baltimore Oriole (*Icterus galbula*)
- Turkey vulture (*Cathartes aura*) (overhead)
- Barn Owl (*Tyto alba*)

Amphibians

- American Toad
- Eastern Newt *(Notophthalmus viridescens)*

Reptiles

- Garter Snake *(Thamnophis sirtalis)*
- Eastern Box Turtle *(Terrapene carolina carolina)*

As stated in Section 3.6, Surface Water, 1 perennial stream (Brinker Run), 25 intermittent streams, and 90 ephemeral streams occur within the Eastern Sporn Tract (see Section 3.6 regarding intermittent and ephemeral stream discussions). Figure 3.8-10 shows typical onsite aquatic and riparian habitat conditions of Brinker Run, which is relatively narrow, shallow, and well-shaded. Compared to streams observed within the pipeline corridors, the overall gradient of Brinker Run provides higher flow velocities. The small size of Brinker Run (i.e., depth and width), however, limits the overall diversity of aquatic habitat and potential for fish species. The eroded slopes (see right side of Figure 3.8-10) indicate flash flows during heavy rainfall events and the potential for erosion/sedimentation into the stream. Figure 3.8-10 also shows the stream water to be a milky-brown color indicating somewhat high turbidity, likely resulting from the aforementioned erosion/sedimentation issues. These conditions reduce the diversity and population size of fish species, mussels, and benthic (bottom-dwelling) macroinvertebrates associated with coarse substrates (i.e., cobble, gravel, and rock) if these substrates are covered with sand and silt. Based on the small size and onsite characteristics of Brinker Run, it is unlikely that suitable habitat exists for federally protected species that have the potential to occur within the project area (see Table 3.8-2).

Figure 3.8-10. Typical View of Brinker Run on the Eastern Sporn Tract

Jordan Tract

As shown in Table 3.8-4, a majority of the Jordan Tract is a natural system vegetation community consisting of South-Central Interior Mesophytic Forest (49 percent; see Figure 3.8-11), Grassland and Scrub/Shrub (18 percent), Appalachian Hemlock-Hardwood Forest (15 percent), Northeastern Interior Dry-Mesic Oak Forest (12 percent), and Central Interior and Appalachian Floodplain Systems (2 percent). Approximately 4 percent of the property consists of a human altered/disturbed vegetation community (developed, open space), primarily due to previous clearing activity and disturbance along Shirley Road.

Field observations during the 2010 summer season included the following wildlife: Carolina chickadee, eastern kingbird (*Tyrannus tyrannus*), cedar waxwing (*Bombycilla cedrorum*), downy woodpecker (*Picoides pubescens*), blue jay, white-eyed vireo, field sparrow, and indigo bunting.

As stated in Section 3.6, Surface Water, 1 perennial stream (Thombleson Run), 9 intermittent streams, and 37 ephemeral streams occur within the Jordan Tract (see Section 3.6 regarding intermittent and ephemeral stream discussions). Figure 3.8-12 shows typical onsite aquatic and riparian habitat conditions of Thombleson Run, which is relatively narrow, shallow, and well-shaded. The overall gradient also provides higher flow velocities, compared to typical stream conditions within the pipeline corridors. The small size of the stream, however, limits the overall diversity of aquatic habitat and potential for fish species. The exposed root structures and slightly eroded streambanks along Thombleson Run possibly indicate flash flows during heavy rainfall events and the potential for erosion/sedimentation into the stream. These conditions could further reduce the diversity and populations of aquatic organisms. Based on the small size and onsite characteristics of Thombleson Run, it is unlikely that suitable habitat exists for federally protected species that have the potential to occur within the project area (see Table 3.8-2).

Figure 3.8-11. Dominant South-Central Interior Mesophytic Forest within the Jordan Tract

Figure 3.8-12. Thombleson Run on the Jordan Tract

Western Sporn Tract

As shown in Table 3.8-4, a majority of the Western Sporn Tract is a natural system vegetation community consisting of South-Central Interior Mesophytic Forest (36 percent; see Figure 3.8-13), Grassland and Scrub/Shrub (26 percent), Central Interior and Appalachian Floodplain Systems (12 percent), Appalachian Hemlock-Hardwood Forest (9 percent), and Northeastern Interior Dry-Mesic Oak Forest (9 percent). Approximately 7 percent of the property consists of a human altered/disturbed vegetation community (developed, open space), primarily due to previous clearing activity and disturbance along Lieving Road.

Field observations during the 2010 summer season was limited to the area within the immediate vicinity of the injection well site located within the far eastern corner of the Western Sporn Tract (see Figure 3.8-1). Wildlife observed within this area included the following wildlife: wild turkey, indigo bunting, and great crested flycatcher (*Myiarchus crinitus*). No surface water resources were observed within this portion of the Western Sporn Tract. Tenmile Creek is located within the Western Sporn Tract, west of the injection well site. As 2010 field observations were limited to the far eastern extent of the Western Sporn Tract, no field documentation exists for the stream characteristics of Tenmile Creek. Sections 3.6, Surface Water, and 3.7 Wetland and Floodplains further describes these resources within the Western Sporn Tract based on online data sources.

Figure 3.8-13. Dominant South-Central Interior Mesophytic Forest within the Western Sporn Tract

Based on the field observations within the location of the injection well site, no habitat (i.e., surface waters) locally occurs for federally protected species (see Table 3.8-2).

3.8.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to biological resources in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.8.1.3.

3.8.3.1 Construction Impacts

Generally, construction of the project would have the potential to result in short-term, negligible to minor impacts to biological resources. Moderate impacts, however, are expected through construction of some of the pipeline corridors. These moderate impacts would be due to forest vegetation removal and the potential for introduction of invasive species. No impacts to protected species are expected. AEP would implement construction BMPs to minimize biological resources impacts.

CO_2 Capture Facility

Construction of the CO_2 capture facility would have the potential to impact approximately 33 acres of previously disturbed, industrial developed, open space land (see Figures 3.8-1 and 3.8-2). As stated in Section 3.8.2.2, this site has been extensively disturbed (i.e., cleared and graded with areas of impervious surface). Overall, construction impacts to this area would result in negligible impacts to biological resources. It is unlikely that migratory birds would use this area as nesting habitat.

Upgrades to the existing barge unloading area would not directly impact aquatic species or habitat within the Ohio River. Site preparation activities associated with this area would occur above the ordinary high-water mark, avoiding direct impacts. Indirect impacts, however, could potentially occur within the Ohio River during grading activities along the riverbanks and adjacent riparian areas within the proposed construction footprint (above normal pool elevation). Construction activities and grading would increase the potential for sedimentation into the Ohio River. AEP would develop and implement erosion control methods and stormwater management plans (see Section 3.4, Physiography and Soils and Section 3.6, Surface Water) to control and prevent erosion and sedimentation, reducing the potential for adverse impacts to aquatic species during site preparation activities at the barge unloading area.

One barge unloading method during construction of the CO_2 facility would use a spud barge and associated placement of up to four temporary H-piles, which would rest into the Ohio River bottom sediments to stabilize the delivery barge during unloading. Potential impacts to less mobile aquatic species are expected to be negligible to minor, as well as temporary in duration considering that placement of the H-pilings would represent a relatively small disturbance area. Construction activities would not commence until 2013; therefore, a mussel survey, and potentially relocation efforts, would be performed for mussel species within the potential area of disturbance prior to the placement of the H-pilings as required by USFWS and WVDNR. Thus, no impacts to mussel species would be expected.

Pipeline Corridors

Table 3.8-5 identifies acreages of temporary and permanent construction impacts to vegetation communities (habitat) for each pipeline corridor segment (see Figure 2-7). During construction, each of the affected vegetation communities would be disturbed and vegetation removed, causing minor to moderate short-term impacts to biological resources.

Land within the operational ROW (approximately 50 feet wide) would be cleared for digging of pipeline trenches; land within the temporary construction ROW (approximately 80 to 120 feet wide) would be cleared for construction staging and/or would be used by equipment and workers. Vegetation from land clearing activities would be chipped or shredded and spread out over the ROW as mulch to support soil stabilization and re-growth of vegetative cover. Marketable timber would be harvested in accordance with landowner/tenant agreements.

Potential impacts (including both temporary and permanent impacts) to biological resources from pipeline corridor construction would range from

- a minimum of 10.4 acres of forest disturbance (Borrow Area Route) to a maximum of 36.7 acres of forest disturbance (Jordan Route 3);
- a minimum of 13.5 acres of grassland and scrub/shrub disturbance (Borrow Area Route) to a maximum of 105.1 acres of grassland and scrub/shrub disturbance (Jordan Route 2); and

- a minimum of no impact (Borrow Area Route) to a maximum of 12.5 acres of agricultural land disturbance (Western Sporn Route).

The vast majority of potentially affected areas support ruderal early successional grassland and scrub/shrub within existing electrical transmission line ROWs (i.e., previously disturbed). As the majority of the study area is located within existing ROW (i.e., which has been previously disturbed with relatively low species diversity and habitat quality), the overall adverse impacts to existing habitat quality from construction disturbance would be minor. The potential for invasive species to colonize disturbed areas associated with pipeline construction would be minor beyond current baseline conditions. Please refer to Section 3.6, Surface Water, and Section 3.7, Wetlands and Floodplains, for a discussion of these resources and potential impacts.

As stated in Section 3.8.2, construction disturbance increases the potential for introduction and spread of invasive species, allows the propagation of non-native plant species, and increases the potential for adverse impacts to native vegetation and habitat quality. Table 3.8-1 identifies the primary invasive species observed during the 2010 field season. Establishment and propagation of invasive plant species along the newly established pipeline corridors would reduce the overall diversity of native plant species and likely reduce the quality of habitat. As the majority of the study area is located within existing ROW (i.e., which has been previously disturbed with relatively low species diversity and habitat quality), the overall adverse impacts to existing habitat quality from construction disturbance would be minor. An increased potential for the introduction of invasive species would exist in newly disturbed areas (i.e., areas of forest clearing) as these areas would be adjacent to the existing ROWs, which contain areas of invasive species. The potential would exist for invasive species to colonize newly disturbed areas following site stabilization and re-seeding within temporary ROW areas. If established, these species could preclude the regeneration of forest and scrub/shrub vegetation, resulting in long-term moderate adverse impacts to biological resources.

Overall, impacts to wildlife from construction of the pipeline corridors would be negligible to minor. A majority of the corridors run parallel to existing electrical transmission line ROWs and roads, which would minimize the overall effect to wildlife and fragmentation of wildlife habitat. Construction activities, including land clearing, would cause a negligible loss of wildlife habitat. This would primarily include loss of ruderal early successional grassland and scrub/shrub habitat located within the existing ROWs and loss of forest edge directly adjacent to these existing ROWs. As the habitats within the pipeline corridors are common within the ROI (i.e., are not unique or critical habitat), overall impacts to wildlife from land clearing would be minor; many species would be able to move to and utilize adjacent, similar habitat types. Certain species with limited range or mobility such as small rodents, reptiles, and amphibians would be more susceptible to potential direct impacts of mortality due to collisions with vehicles and equipment. Other, more mobile species, such as larger mammals and birds would be less susceptible to these impacts; however, ground-nesting bird nests and their eggs could potentially be disturbed or destroyed during the land clearing process.

In order to mitigate for potential violations of the MBTA, AEP has committed to performing migratory bird screenings prior to any land clearing activities to be performed during the migratory bird nesting season (April through July). The screenings would be performed by qualified biologists and would consist of searching the areas to be cleared for migratory bird nests and birds exhibiting nesting behaviors. Should any nests be found, AEP would either avoid disturbing the nest, if practicable, or coordinate with USFWS on an appropriate course of action. In addition, construction personnel would be trained to recognize nests and birds exhibiting nesting behaviors. Should construction crews encounter nests or other bird issues (e.g., deceased or injured birds), work would be stopped until the concerns can be appropriately investigated. Any potential MBTA issues encountered during construction would either be avoided, if practicable, or coordination with USFWS would be performed to determine the appropriate course of action (also see Section 4.3, Mitigation Measures).

In addition to direct mortality, habitat fragmentation could occur from construction of the pipeline corridors, particularly in areas where forest clearing is required. As previously stated, impacts would be minimized by routing the pipelines adjacent to existing ROWs. In general, habitat fragmentation can have the effect of reducing the genetic diversity of a population should they become geographically isolated from other populations of the same species. Although the pipeline ROWs would not necessarily create impassable barriers to wildlife movement, from a behavioral perspective, some species may not cross a location because the area was disturbed, habitat was altered, etc. In addition, habitat fragmentation can reduce the overall size of accessible habitat to a population, which may result in the area no longer being viable to support that population at its existing numbers (e.g., food resources could become too limited). Fragmentation effects could be most detrimental in the case of forest interior dwelling, ground-nesting songbirds and Neotropical migrants (i.e., species that breed in North America during summer months and spend winters in Mexico, Central America, South America, or the Caribbean islands) in particular.

The creation of grassy linear corridors through once forested areas can create open areas by which predatory species (e.g., raccoon) could access forest interior landscapes and prey on the eggs of ground-nesting birds. Conversely, the creation of these corridors could benefit these predatory species by allowing them greater access to food resources. The creation of linear corridors through forested landscapes can also increase the potential for brood parasitism of ground-nesting bird nests. Parasitic bird species (e.g., cowbird [*Molothrus ater*] and swallows [*Tachycineta spp.*]) can affect a brood of fledgling birds by laying eggs in the nests of other bird species and leaving the chick-rearing responsibilities to the other bird parents; often the parasitic chicks will outcompete the host chicks for food and in some cases, may push them out of the nest. These detrimental fragmentation effects may extend up to 2,000 feet into a forest (EPA, 1994). Overall, the loss of forested habitat itself would have a minimal effect on migratory bird species as abundant, comparable habitat is available throughout the ROI.

Noise generated by construction activities would likely cause wildlife species to avoid the construction site. As this disturbance would be temporary, impacts to wildlife from construction noise would be short term and minor.

Construction of the pipeline corridors could result in short-term, minor adverse impacts to aquatic resources (see Section 3.7, Wetlands and Floodplains). In addition, clearing to accommodate the proposed pipelines would result in a loss of forested terrestrial habitat a longer term (i.e., 20 to 30 years for recovery) loss of forest would occur within the temporary ROW, while a permanent loss of forest would occur within permanent ROWs (see Table 3.8-5).

The pipelines would cross surface water features (see Section 3.6, Surface Water, for more detailed information on water crossings). Use of directional drilling would avoid direct impacts to these surface water features. For construction not involving directional drilling, a trench would be excavated and dewatered in accordance with applicable federal, state, and local regulations and Section 404 (of the CWA) permitting requirements. During construction, AEP would implement measures to avoid, minimize and mitigate impacts to aquatic habitat, as necessary. Staging areas would be limited to upland areas. The temporary construction ROW would be narrowed within aquatic environments (i.e., streams and wetlands). Aquatic habitat, including streambanks and streambed substrate, would be restored to original grade following instream trenching activities. Streambanks would be restored using appropriate stabilization measures and revegetated following specifications outlined in Section 404 permitting.

Table 3.8-5. Potential Pipeline Route Construction Disturbances to Biological Resources

Potential Injection Well Site	Potential Pipeline Route[a]	Resource Impact Type (acres)[b]										Resource Impact Rating
		Permanent Loss of Forest	Temporary Loss of Forest	Total Construction Disturbance to Forest	Permanent Loss of Grassland and Scrub/Shrub	Temporary Loss of Grassland and Scrub/Shrub	Total Construction Disturbance to Grassland and Scrub/Shrub	Permanent Loss of Agricultural	Temporary Loss of Agricultural	Total Construction Disturbance to Agricultural	Number of Perennial Stream Crossings	
Mountaineer Plant	Plant Routing											Neg
Borrow Area	Borrow Area Route	4.3	6.1	10.4	5.5	8.0	13.5				3	Min
Eastern Sporn Tract	Eastern Sporn Route 1	6.8	9.5	16.3	18.1	25.7	43.8	1.1	1.4	2.5	7	Min
	Eastern Sporn Route 2	9.0	15.3	24.3	36.1	49.9	86.0				10	Mod
	Eastern Sporn Route 3	10.1	14.3	24.4	13.5	19.1	32.6	3.0	4.0	7.0	5	Mod
	Eastern Sporn Route 4	13.2	21.1	34.3	30.3	41.4	71.7	4.0	5.4	9.4	9	Mod
Jordan Tract	Jordan Route 1	10.8	15.8	26.6	40.0	57.4	97.5	0.3	0.4	0.7	**13**	Mod
	Jordan Route 2	8.2	11.4	19.6	**43.0**	**62.1**	**105.1**	*0.1*	*0.2*	*0.3*	11	Mod
	Jordan Route 3	**15.0**	**21.7**	**36.7**	34.1	49.0	83.1	**4.3**	5.8	10.2	**13**	Mod
	Jordan Route 4	12.3	17.2	29.5	37.1	53.6	90.7	4.1	5.6	9.7	11	Mod
Western Sporn Tract	Western Sporn Route	6.0	12.1	18.1	42.1	*1.7*	43.8	3.7	**8.8**	**12.5**	3	Min

Impact Intensity Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] See Table 2.8 for descriptions of the Potential Pipeline Routes.

[b] Permanent impacts refer to those which occur within the permanent (50-foot) ROW; these areas would be subject to maintenance activities during the lifetime of the project. Temporary impacts refer to those which occur in the temporary ROW (up to 35 feet on either side of the permanent ROW).

Note: Shaded cells in the table indicate resource absence; bolded numbers indicate the pipeline routing option with the maximum level of potential disturbance to each resource type.

Aquatic habitats would likely recover shortly after construction activities, resulting in a short-term, minor adverse impact. Section 3.4, Physiography and Soils, and Section 3.6, Surface Water, further discuss BMPs used during construction for protection of surface waters and required construction permitting (e.g., NPDES requirements for construction sites disturbing over 1 acre of land and Section 404 permitting).

Excavation in waterways would temporarily remove the affected area (i.e., typically an area up to 50-feet wide, associated with the permanent ROW) as viable habitat for aquatic life, as the area would be dewatered. This could result in the temporary removal of breeding habitat for certain amphibian species during construction. Disturbance of bank and bottom sediments could cause some degree of temporary downstream sedimentation, which could have negative effects to aquatic life primarily because the sediments can fill in open spaces within the steam bed that provide habitat for aquatic macroinvertebrates (e.g., insects). Therefore, instream construction activities could cause a localized and temporary decline in insect populations, reducing available food resources for larger species (e.g., fish) within the affected segment of the stream. As sediments are a common stream occurrence within the study area and existing aquatic species have adapted to such conditions, only minor impacts to aquatic species would be expected. Section 404 permitting requirements and associated BMPs (discussed above) would further avoid or minimize impacts to aquatic habitat and species.

As stated in Section 3.8.2.3, streams within the pipeline corridors are unlikely to support protected species. Furthermore, the site-specific 2010 Indiana bat surveys did not detect this endangered species within the study area. Therefore, construction of the pipeline segments is unlikely to affect species protected under Section 7 of the ESA.

Following construction, habitats disturbed by construction within the temporary ROW would be re-contoured, stabilized, and allowed to return to natural conditions, reducing the overall permanent loss of habitat (see Section 3.8.3.2 for a description of permanent operational impacts). Agricultural lands within the temporary ROW would likely be returned to agricultural production by existing land owners. Grassland areas would likely recover within the 1 year following the end of construction, whereas forested areas would take up to 30 years to fully recover. Although the forested and scrub/shrub communities within the temporary ROW areas have the potential to recover in the long-term, impacts to these systems are considered moderate due to the length of recovery and the potential for introduction and spread of invasive species.

Injection Well Sites

Tables 3.8-6 through 3.8-8 quantify the potential construction impacts to vegetation communities at each of the injection well sites (see Figure 2-7). Each site would include an approximate 5-acre temporary construction laydown area (see Table 3.8-6), including an approximate 0.5-acre operation area. In addition, unless indicated, each of these sites would require construction of a pipeline spur from the main pipeline corridor to the injection well site (see Table 3.8-7) and an access road (see Table 3.8-8).

Construction of the proposed injection well sites, pipeline spurs, and access roads would require clearing and grading. This would remove vegetation and associated wildlife habitat. During construction, each of the affected habitats in Tables 3.8-6 through 3.8-8 would be removed. The resulting impacts to biological resources from the construction of the injection well sites, pipeline spurs, and access road would be negligible to minor.

As the Mountaineer Plant and Borrow Area injection well sites are classified as developed, medium intensity industrial lands (i.e., gravel lot or active borrow area), no biological resource impacts would occur. The remaining sites would disturb up to 5 acres of forested land (see Table 3.8-6). Of the 5-acre disturbance, only 0.5 acre would be permanently disturbed; the remaining 4.5 acres would be temporary. Grassland areas would likely recover within the 1 year following the end of construction, whereas forested areas would take up to 30 years to fully recover. Although the forested and scrub/shrub communities within the temporary ROW areas have the potential to recover in the long term, adverse impacts to these systems are considered moderate due to the length of recovery and the potential for introduction and spread of invasive species as described previously. Construction of the pipeline spurs would not impact biological resources at the Mountaineer Plant, Borrow Area, or Western Sporn Tract injection well sites (see Table 3.8-7). Section 3.7, Wetlands and Floodplains, discusses existing wetland conditions and potential impacts to wetlands within the Western Sporn Tract. At other injection well sites, pipeline spur construction impacts would range up to 10.6 acres at the Eastern Sporn Corridor, spur to ES-2 (see Table 3.8-7).

Construction of the access roads would result in negligible (typically under 1 acre) biological resource impacts. The greatest impact (1.2 acres) would result from the construction of Eastern Sporn Corridor, access road to Injection Well Site ES-2 (see Table 3.8-8).

Noise generated by construction would have the potential to cause wildlife species (including migratory birds) to avoid the construction areas. Given the relatively small areas involved, the lack of unique biological resources, and the ability of wildlife species to move to other areas during construction, these impacts would be negligible.

Table 3.8-6. Potential Injection Well Site Construction Impacts to Biological Resources

Potential Injection Well Site	Injection Well Site Option	Resource Impact Type (acres)[a]							Resource Impact Rating
		Permanent Loss of Forest	Temporary Loss of Forest	Permanent Loss of Grassland and Scrub/Shrub	Temporary Loss of Grassland and Scrub/Shrub	Permanent Loss of Agricultural	Temporary Loss of Agricultural	Number of Perennial Stream Crossings	
Mountaineer Plant	MT-1								Neg
Borrow Area	BA-1								Neg
Eastern Sporn Tract	ES-1	0.5	5.0						Min
	ES-2	0.5	5.0						Min
	ES-3	0.5	5.0						Min
Jordan Tract	JT-1	0.5	5.0						Min
Western Sporn Tract	WS-1	0.5	5.0						Min

Impact Intensity Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] Permanent impacts refer to those that occur within the permanently disturbed (i.e., impervious surface or permanently maintained) required for operations (e.g., injection well site, lawn, and parking areas). Temporary impacts refer to those that occur in the construction staging areas (locations that would be re-vegetated following construction and are not required for operations).

Note: Shaded cells in the table indicate resource absence.

Table 3.8-7. Potential Biological Resource Impacts Associated with Pipeline Spur Options

Potential Injection Well Site	Pipeline Segment Option	Pipeline Spur Option to Injection Well Site	Resource Impact Type (acres)[a]							Resource Impact Rating[a]
			Permanent Loss of Forest	Temporary Loss of Forest	Permanent Loss of Grassland and Scrub/Shrub	Temporary Loss of Grassland and Scrub/Shrub	Permanent Loss of Agricultural	Temporary Loss of Agricultural	Number of Perennial Stream Crossings	
Mountaineer Plant	NA[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Borrow Area	North Segment B	Spur to BA-1								Neg
Eastern Sporn Tract	Blessing Road Segment B	Spur to ES-1	0.5	1.2						Neg
		Spur to ES-2	1.8	4.5						Min
		Spur to ES-3	2.8	6.7						Min
	Eastern Sporn Corridor	Spur to ES-1	2.8	6.8	0.3	0.7				Min
		Spur to ES-2	2.5	6.2	0.3	0.7				Min
		Spur to ES-3	0.4	1.1	0.5	1.1				Neg
Jordan Tract	Jordan West Corridor	Spur to JT-1	1.0	2.6	2.1	4.8				Min
	Jordan East Corridor	Spur to JT-1	1.0	2.6	2.1	4.8				Min
Western Sporn Tract	Foglesong Corridor	Spur to WS-1	NA	NA	NA	NA	NA	NA	NA	NA

Impact Rating Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] Permanent impacts refer to those that occur within the permanent (50-foot) ROW; these areas would be subject to maintenance activities during the lifetime of the project. Temporary impacts refer to those that occur in the temporary ROW (up to 35 feet on either side of the permanent ROW).

[b] NA = Not applicable; the spur would be located entirely within the potential 5-acre injection well site.

Note: Shaded cells in the table indicate resource absence.

Construction of the injection well sites, pipeline spurs, and access roads would result in potential minor adverse impacts to migratory birds. Loss of habitat would have a minimal potential impact on migratory bird species as abundant, comparable habitat is available in the ROI. During construction, ground-nesting migratory bird nests could be disturbed or destroyed, though AEP has developed mitigation measures to address this issue, and development of these features could result in habitat fragmentation impacts (see "Pipeline Corridors" for a more detailed discussion of these impacts and mitigation measures).

Following construction, the temporarily disturbed land areas would be re-contoured and re-seeded with a state-approved grass seed mixture appropriate to the area. This would restore vegetation communities to pre-project conditions, reducing long-term impacts to biological resources. As noted previously, areas temporarily disturbed during construction could increase the potential for establishment and propagation of invasive plant species. Establishment of these species could cause minor to moderate localized adverse impacts to biological resources by reducing the diversity of plant species and quality of habitat.

Table 3.8-8. Potential Access Road Construction Impacts to Biological Resources

Potential Injection Well Site	Route Option	Injection Well Site Option	Resource Impact Type (acres)[a]							Resource Impact Rating
			Permanent Loss of Forest	Temporary Loss of Forest	Permanent Loss of Grassland and Scrub/Shrub	Temporary Loss of Grassland and Scrub/Shrub	Permanent Loss of Agricultural	Temporary Loss of Agricultural	Number of Perennial Stream Crossings	
Mountaineer Plant	NA	MT-1								Neg
Borrow Area	Borrow Area Route	BA-1								Neg
Eastern Sporn Tract	Eastern Sporn Route 1	ES-1	0.3							Neg
		ES-2	1.2							Neg
		ES-3	0.3							Neg
	Eastern Sporn Route 2	ES-1	0.3							Neg
		ES-2	1.2							Neg
		ES-3	0.3							Neg
Jordan Tract	Jordan Route 1	JT-1[b]								Neg
	Jordan Route 2	JT-1[b]								Neg
Western Sporn Tract	Foglesong Corridor	WS-1	0.1							Neg

Impact Intensity Key: Neg = negligible; Min = minor; Mod = moderate; Sub = substantial; Ben = beneficial

[a] Permanent impacts refer to those which occur within the permanent (approximately 15-foot) ROW; these areas would be covered by impervious surfaces associated with the roadbed. Approximately 7 feet on either side of the roadbed would also be disturbed to provide road shoulders and ditching, as appropriate. As these areas were once forested and would now be permanently maintained features, their impacts were also considered permanent in nature.

[b] No new access road would be required for the JT-1 injection well site as an existing road would be used to access the site.

Note: Shaded cells in the table indicate resource absence.

No aquatic resources occur within the injection well sites, pipeline spurs, or access roads. As such, no impacts to aquatic resources would occur during construction. Indirect impacts to nearby water resources would be avoided through use of BMPs (see Section 3.4, Physiography and Soils, and Section 3.6, Surface Water, regarding required construction permitting [e.g., NPDES requirements for construction sites disturbing over 1 acre of land] and BMPs used during construction for protection of surface waters).

As stated in Section 2.3.1 in Chapter 2, AEP has developed the siting criteria that would be used in the event that a project component (e.g., injection well) would have to be re-located to an alternate location within the same injection well property, as well as for the siting of the monitoring wells. This could occur due to the results of the pending well geologic characterization study and ongoing design. The following siting criteria would avoid or minimize impacts to biological resources:

- Avoid wetlands –Wells would not be sited in wetland areas to the extent practical.
- Avoid streams and floodplains –Wells would be sited to avoid streams/floodplains and minimize the number of potential stream crossings, to the extent practical.
- Avoid sensitive habitat - Wells would not be sited in areas that have been identified as sensitive habitats.

3.8.3.2 Operational Impacts

CO_2 Capture Facility

Overall, negligible biological resources impacts would be expected from the operation of the CO_2 capture facility. As the proposed site is located within a disturbed industrial site with high levels of human activity, no impacts to biological resources (i.e., beyond those described for construction) would be anticipated. No long-term noise, light and glare, or air quality impacts to biological resources would be anticipated.

As stated in Section 2.3.3.4, industrial wastewater would be generated from the new CO_2 capture system. The wastewater generated by the CO_2 capture system would be sent to the existing industrial wastewater treatment system at the Mountaineer Plant. In the event that the existing treatment system does not have sufficient capacity to treat the wastewater generated from the CO_2 capture facility, a new WWTP would be constructed as part of the project. All treated wastewater would be discharged to an existing NPDES permitted outfall. The additional wastewater and stormwater runoff would be expected to have no greater than minor impacts on water levels and quality and, ultimately, aquatic life in the Ohio River as this is a relatively small increase in discharge and the additional discharges would remain within limits set forth in their existing NPDES permit No. WV0048500.

Amine-Based Capture System Feasibility Study

Emissions of amines to the atmosphere may result from the operation of an amine-based CO_2 capture system. The composition of those emissions would depend, in large part, on the amines present in the solvent solution and any additives that are used. The amines that are emitted would likely degrade in the atmosphere. Deposition of certain amines and amine degradation products into surface waters has the potential to contribute to nutrient loading; however, the effects of amine emissions have not been fully assessed. The deposition of amines into water bodies would have the potential to adversely affect invertebrates, fish, and algae, depending upon the amines that are deposited and what concentrations are present in the water body. Amines that are deposited on plants could promote growth. Amines could degrade in the soil into nitrogen compounds available for plant growth; however, the effects would be dependent on the amount of nitrogen exposed to the plants and vegetation (Bellona, 2009). The feasibility study would evaluate this issue in more detail.

Pipeline Corridors

During operations, biological resource impacts within the proposed pipeline corridors would be limited to regular maintenance activities within the permanent ROW. Maintenance activities would involve a combination of clearing and herbicide activities at a frequency necessary to maintain the reliability and performance of the line (generally at least once every 4 years). Table 3.8-4 provides a summary of the vegetation communities that would be permanently converted to grasslands. These impacts have been addressed in Section 3.8.3.1.

Due to the permanent conversion of minor acreage of active cropland to grasslands, a slight increase to the overall quality of habitat would occur in these areas.

Permanent conversion of scrub/shrub areas to grasslands would occur. Species typically using scrub/shrub areas are common to both grassland areas and forest edges. Therefore, the overall impact from the permanent loss of scrub/shrub habitat would be minor.

Permanent conversion of forested areas to grasslands would occur. Permanent forest removal would result in forest fragmentation. As a majority of the pipeline corridors occur along existing ROWs or roads, overall impacts from forest fragmentation in these areas would be minor.

Certain pipeline routes do not occur along existing ROWs or roads, and new ROWs would be required. These routes include Eastern Sporn 2, 3, and 4; and Jordan 1, 2, 3, and 4 (with each option involving one or a combination of East Corridor A, South Segment D, and/or the Jordan West Corridor segments). Forest fragmentation within these areas could reduce the number of species that are present, resulting in a moderate localized impact to wildlife habitat. Small fragments of habitat typically support a smaller diversity of plant and animal populations. Forest fragmentation can also lead to edge effects, influencing the microclimate of the forest with increases in light, temperature, and wind. These changes in microclimate can change the remaining adjacent forest vegetation and wildlife habitat dynamics by reducing the quality of habitat for species that require interior habitat (also see Section 3.8.3.1 "Pipeline Corridors" for additional discussion on habitat fragmentation impacts).

If a leak or rupture of the pipeline occurred, biological resource impacts would be minor and localized. Respiratory effects to biota due to increased atmospheric CO_2 concentrations would be limited to the immediate vicinity of the pipeline. The pipeline is expected to be buried to a depth of about 3 feet and 4 feet in cultivated areas. Thus, if a leak or rupture occurred, the released gas would first migrate into the soil gas and displace the ambient air. Serious respiratory effects to biota due to atmospheric CO_2 concentrations are unlikely to occur, except in the immediate vicinity of the pipeline where the rupture or leak occurred. Olfactory and respiratory effects to biota from the ammonia could also occur in the immediate vicinity of a pipeline release at the time of release. Soil gas concentrations can be higher depending on soil type, so effects on soil invertebrates or plant roots could occur close to the segment where the pipe failed or leaked.

Some of the pipeline routes to the injection well sites cross streams. Thus, there is a potential for the captured gas to be released into surface water. The volume of released gas would first displace ambient soil gas and then be released into the surface water. Both CO_2 and ammonia would dissolve in the water up to their respective solubilities, given the pH, TDS, and temperature of the water at the time of the leak. The CO_2 concentration in the water is unlikely to reach 2 percent (i.e., when injuries to aquatic life can occur), since the solubility of CO_2 at typical atmospheric conditions would keep the concentration less than about 0.2 percent. The ammonia concentration and impact to biota also depends on the pH of the water at the time of the release.

Minimal additional ROW maintenance beyond current, baseline conditions is expected to be required. Potential impacts from the maintenance activities on biological resources are expected to be minor.

During ROW maintenance activities, wildlife could be killed or displaced by maintenance equipment. Given the relatively small areas involved, the lack of unique biological resources, and the ability of wildlife species to move to other areas during maintenance activities, these impacts would be minor. Potential impacts to threatened and endangered species would be evaluated and mitigated in consultation with the USFWS and WVDNR.

Injection Well Sites

Operation of the proposed injection well sites would not cause direct impacts to biological resources. Indirect operational impacts could occur from the increased potential for the introduction and spread of invasive species along newly established access roadways. As these roads would experience low volumes of traffic and would be restricted to AEP personnel, the potential for invasive species introduction would be negligible beyond current baseline conditions. In addition, permanent forest removal would result in forest fragmentation; impacts of which are described under "Pipeline Corridors" and in Section 3.8.3.1.

Injection of CO_2 into geological formations would have the potential to impact subsurface microbes. Subsurface microbes constitute over 50 percent of the biomass on this planet (NETL, 2010d); however, little research exists regarding the impact of CO_2 injection on the subsurface microbial community (Morozova et.al., 2010). A study was conducted to analyze the composition and activity of the microbial community of a saline CO_2 storage aquifer and its response to CO_2 injection. The study found the availability of CO_2 has an influence on the metabolism of microorganisms (Morozova et.al., 2010).

Within the U.S., the National Energy Technology Laboratory is partnering with the University of Illinois Urbana-Champaign (UIUC) to provide cross-disciplinary training and research opportunities for undergraduate and graduate students in CCS. This partnership will involve students and staff from UIUC and will collect and identify microbes in subsurface samples from the Mt. Simon Sandstone (a candidate CCS reservoir) both before and after injection of CO_2, to observe how CO_2 injection impacts the subsurface microbial community. The total set of observations will permit characterization of the subsurface microbial community in a CCS reservoir in the context of the local reservoir environmental conditions, sedimentary substrate, and pore-water environment (NETL, 2010d). Although this study is in the preliminary stages, results will likely further aid in the understanding of the effects of CO_2 injection on subsurface microbial communities.

Due to the lack of research and data, effects on subsurface microbial communities cannot be quantified. As shown within the German study, CO_2 sequestration has the potential to alter microbial communities by altering the pH of the underground environment; however, it also indicated that the bacterial community was able to adapt to the extreme conditions of the deep biosphere and to the extreme changes of these conditions. Impacts due to CO_2 injection for the purpose of sequestration from the project would likely have negligible to minor impacts to microbial communities, however, as previously stated, further research is needed to further understand the effects of CO_2 injection on these communities.

Potential impacts to biological resources associated with maintenance activities at the injection well site would be minor. Long-term noise, light and glare, or air quality impacts to biological resources would be negligible.

3.8.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to biological resources.

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3.9 CULTURAL RESOURCES

3.9.1 Introduction

This section identifies and describes cultural resources potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects from this project on these resources.

NEPA recognizes the impacts of human activity on the environment, including industrial development and new and expanding technological advances, and further recognizes the importance of maintaining environmental quality during the course of development projects. Among the responsibilities of the federal government set forth in NEPA is to "preserve important historic, cultural, and natural aspects of our national heritage…" (Sec. 101: 42 USC 4331[b][4]).

Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 CFR 800 (incorporating amendments effective August 5, 2004) "*require federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings.*"

> The National Historic Preservation Act of 1966 (16 USC 470), as amended, establishes a program for the preservation of historic properties throughout the nation.

Under NHPA Section 106, a historic property is "*any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior.*" Historic properties can include "artifacts, records, and remains related to and located within such properties…[P]roperties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet National Register criteria" (36 CFR 800.16[l][1]) are also historic properties.

For purposes of this EIS, cultural resources are

- archaeological resources, including prehistoric and historic archaeological sites;
- historic resources, including extant standing structures;
- cultural or historic landscapes or viewsheds;
- Native American resources, including Traditional Cultural Properties important to Native American tribes; or
- other cultural resources, including extant cemeteries and paleontological resources.

NHPA Section 106 mandates that federal agencies consider the effects of federally funded and permitted undertakings on historic resources listed in or eligible for listing in the NRHP (16 USC 470). There are four criteria under which a historic resource (building, object, structure, site, or district) may be listed in the NRHP. These criteria are contained in Chapter VI, "How to Identify the Type of Significance of a Property," contained in National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation* (NPS, 1990):

> *"The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects…:*
>
> *A. That are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *B. That are associated with the lives of significant persons in our past; or*
>
> *C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic*

values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. *That have yielded or may be likely to yield, information important in history or prehistory.*

Ordinarily cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

a. *A religious property deriving primary significance from architectural or artistic distinction or historical importance; or*
b. *A building or structure removed from its original location but which is primarily significant for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or*
c. *A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building associated with his or her productive life; or*
d. *A cemetery that derives its primary importance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or*
e. *A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or*
f. *A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or*
g. *A property achieving significance within the past 50 years if it is of exceptional importance."*

In addition to possessing or satisfying one or more of the NRHP criteria, a historic resource must also retain its integrity, defined as "the ability of the historic resource to convey its significance." The NRHP recognizes seven aspects of integrity which, in combination, are essential to conveying its significance. These aspects include integrity of location, design, setting, materials, workmanship, association and feeling and are further defined in Part VIII of Bulletin 15, "How to Evaluate the Integrity of a Property."

36 CFR 800 outlines procedures to comply with NHPA Section 106. Under 36 CFR 800(a), federal agencies are encouraged to coordinate NHPA Section 106 compliance with any steps taken to meet the requirements of NEPA, and to coordinate their public participation, review, and analysis in such a way that they can meet the purposes and requirements of both the NEPA and the NHPA in a timely and efficient manner. The Section 106 process has been initiated for the Mountaineer CCS II Project with the intent of coordinating that process with DOE's obligations under NEPA regarding cultural resources.

Participants in the Section 106 process include an agency official with jurisdiction over the undertaking, the Advisory Council on Historic Preservation, consulting parties, and the public. Consulting parties include the State Historic Preservation Office (SHPO); Native American tribes, Native Hawaiian, and Native Alaskan organizations; representatives of local government; applicants for federal assistance, permits, licenses, and other approvals; and additional consulting parties that include individuals and organizations with a demonstrated interest in an undertaking due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the effects of the undertakings on historic properties.

The NHPA Section 106 process is conducted in parallel with the West Virginia Division of Culture and History process, as required by Chapter 29 of the Code of West Virginia, Title 82. Series 2 of this legislation, "Standards and Procedures for Administering State Historic Preservation Programs," establishes the West Virginia Division of Culture and History as the SHPO and its Director as the SHPO (82 CSR 2). Section 3 establishes the West Virginia Register of Historic Places and defines its criteria for designation. Section 5, "State Review Process," defines the role of the SHPO during reviews of both federal and state projects in West Virginia.

3.9.1.1 Region of Influence

The **Area of Potential Effect** is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist (36 CFR 800.16[d]).

The ROI for archaeological resources is referred to as the Area of Potential Effect (APE), and is defined as all project areas where ground would potentially be disturbed from new construction. For architectural resources, the APE is defined as a distance of 500 feet from the potential pipeline corridors, injection well sites, and access roads. For any permanent project-related structures or facilities to be built on the existing Mountaineer Plant (e.g., the CO_2 capture facility and Injection Well Site MT-1), the APE is defined as the footprint of these proposed facilities, as well as those areas immediately adjacent to the proposed facility. The viewshed of any proposed structures or facilities at the Mountaineer Plant was not used to define the APE, as the presence of existing facilities at the Mountaineer Plant generates a greater visual impact than the proposed facilities, which would be considerably smaller.

3.9.1.2 Method of Analysis

DOE conducted a literature review and site file search at the West Virginia State Historic Preservation Office (WVSHPO) and Archives in Charleston to identify and review published and unpublished histories of Mason County and the surrounding areas, cartographic data (including historic USGS topographic maps and soil survey maps), previous cultural resource management reports, and other relevant documentation on the prehistoric and historical resources in the area. DOE reviewed state archaeological site files, NRHP-listed and NRHP-eligible properties, files on previously surveyed historic structures, and associated GIS-based maps of archaeological and historic architectural sites within a 1-mile radius of the CO_2 capture facility, pipeline corridors, and injection well sites. Local historical societies and preservation groups previously identified by the WVSHPO were also solicited for input on the locations of possible archaeological and architectural resources.

DOE performed a Phase I archaeological survey in July and August 2010 of the pipeline corridors and injection well sites in order to identify potentially significant archaeological resources. The survey was conducted in accordance with the methods presented in a June 1, 2010 letter to the WVSHPO. The WVSHPO approved the proposed methodology on July 1, 2010. The results of the archaeological survey are presented in the *Phase I Archaeological Survey* included as Appendix H. The field survey followed the WVSHPO *Guidelines* and consisted of systematic shovel testing and pedestrian survey along transects within the project area. Shovel tests were excavated at 49.2-foot (15-meter) intervals based on probability for archaeological site occurrence. Per WVSHPO *Guidelines*, shovel tests measured at least 19.7 inches (50 centimeters) in diameter and were excavated to sterile subsoil. All excavated soil was screened through 0.25-inch (0.04 centimeters) hardware cloth, and soil strata within each shovel test were recorded on standardized forms describing Munsell color and USDA soil types. Artifacts recovered from shovel tests or ground surface were retained for laboratory analysis. All shovel tests were backfilled after completion, surveyed using a Trimble GPS unit, and plotted on aerial photographs and project maps.

DOE conducted a Phase I/II historic architectural survey in July 2010. The results of the architectural survey are presented in Appendix H: *Phase I/II Historic Architectural Survey*. The survey included all historic standing structures—buildings, structures, objects, districts, and sites 50 years or older—within the APE. Following background research and a search for previously identified architectural resources within the APE, DOE conducted a field survey to identify historic resources listed in or eligible for listing in the NRHP. Fieldwork involved recording architectural characteristics at the reconnaissance level on the relevant WVSHPO structure survey forms. Digital and black-and-white film photographic documentation of the resources included one or more views of the surveyed individual resources. DOE evaluated the NRHP eligibility of the surveyed resources based on the NRHP criteria, including historic significance and integrity. By letter dated January 11, 2011, WVSHPO concurred with the NRHP eligibility evaluations presented in the submitted Phase I/II survey report (see Appendix C). Based on this concurrence, DOE has conducted an assessment of anticipated project effects to NRHP-eligible historic resources. WVSHPO concurrence with DOE's assessment of effects is pending.

To support preliminary project engineering and design, AEP plans to develop up to three characterization wells that will be used to characterize subsurface conditions and assess their suitability for CO_2 storage. On August 27, 2010, AEP requested advance approval from the WVSHPO to proceed with development of the initial characterization well at the Borrow Area property. The West Virginia State Historic Preservation Officer provided approval for geologic characterization activities at the Borrow Area site on September 20, 2010. On October 15, 2010, AEP requested advance approval from the WVSHPO for the second characterization well site at the Jordan Tract. By letter of November 8, 2010 the WVSHPO provided approval for geologic characterization activities at the Jordan Tract. See Appendix C for copies of these correspondences.

3.9.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to cultural resources based on whether the project would directly or indirectly

- cause the potential for loss, isolation, or alteration of an archaeological resource eligible for NRHP listing;
- cause the potential for loss, isolation, or alteration of the character of a historic site or structure eligible for NRHP listing or introduce visual, audible, or atmospheric elements that would adversely affect a historic resource eligible for NRHP listing;
- cause the potential for loss, isolation, or alteration of Native American resources, including graves, remains, and funerary objects or introduce visual, audible, or atmospheric elements that would adversely affect the resource's use;
- cause the potential for loss, isolation, or alteration of a paleontological resource eligible for listing as a National Natural Landmark; or
- cause the potential for loss, isolation, or alteration of a cemetery.

3.9.2 Affected Environment

3.9.2.1 CO_2 Capture Facility

<u>Archaeological Resources</u>

Research conducted at the WVSHPO indicates that no NRHP-listed archaeological resources or archaeological resources that have been determined to be eligible for the NRHP occur within a 1-mile radius of the area proposed for the CO_2 capture facility or the barge unloading area. Six archaeological sites (46MS296, 46MS297, 46MS301, 46MS302, 46MS303, and 46MS304) were previously recorded within a 1-mile radius of the Mountaineer Plant; however, the WVSHPO determined that sites 46MS296, 46MS301, and 46MS302 are ineligible for the National Register, and there has been no determination of eligibility for sites 46MS297, 46MS303, and 46MS304. A Phase I archaeological survey to identify archaeological sites within the impact areas of the CO_2 capture facility was limited to visual inspection and photographic documentation. The survey determined that no archaeological resources occur within the area for the CO_2 capture facility. The proposed upgrades to the existing barge unloading area would occur within a previously disturbed area at the Mountaineer Plant associated with the existing barge unloading area. A 2005 archaeological survey in this area did not identify any archaeological deposits.

Historic Resources

Research conducted at the WVSHPO indicates that no NRHP-listed historic resources occur within a 1-mile radius of the capture facility or the barge unloading area. The WVSHPO determined that two historic resources within the APE of the Mountaineer Plant—the Graham Station School (MS-0180) on State Route 62 and the B&O Railroad (MS-0178) (Ohio River Division) — are eligible for listing in the NRHP under Criterion A. In addition, the Graham Cemetery (MS-0177) and the Graham Station Baptist Church (MS-0179), both on State Route 62, are within the APE of the Mountaineer Plant. The Graham Station Baptist Church was determined to be ineligible for NRHP listing by the WVSHPO in 2005. The Graham Cemetery was determined ineligible for NRHP listing by letter from the WVSHPO dated January 10, 2011. There are no other previously recorded architectural resources within the 500-foot APE of the CO_2 capture facility or the barge unloading area. An architectural survey conducted in July 2010 to identify historic resources 50 years or older within the APE of the CO_2 capture facility determined that there are no additional resources (see Appendix H). An additional architectural survey conducted in December 2010 to identify historic resources 50 years or older within the APE of the barge unloading area determined that there are no additional resources (see Appendix H).

Native American Tribes

DOE began coordination with the following tribes in order to determine if Native American resources of special importance are present in the project area: Keweenaw Bay Indian Community, Delaware Nation, Prairie Band of Potawatomi Nation, Wyandotte Nation, Seneca Nation of Indians, Shawnee Tribe, Seneca-Cayuga Tribe of Oklahoma, and Cayuga Nation. DOE is awaiting responses from the tribes.

3.9.2.2 Pipeline Corridors

Archaeological Resources

Research conducted at the WVSHPO indicates that no NRHP-listed archeological resources or archeological resources that have been determined eligible for the NRHP occur within a 1-mile radius of the pipeline corridors. One archaeological site (46MS304) had been previously recorded within a 1-mile radius of the Western Sporn Corridor; however, there has been no determination of NRHP eligibility for this site. Six archaeological sites (46MS296, 46MS297, 46MS301, 46MS302, 46MS303, and 46MS304) were previously recorded within a 1-mile radius north of the Western Sporn Corridor and west of the North Corridor. The WVSHPO has determined that sites 46MS296, 46MS301, and 46MS302 are ineligible for listing in the NRHP. Sites 46MS297, 46MS303, and 46MS304 have not been evaluated for NRHP eligibility. In addition, two previously recorded archaeological sites are located within a 1-mile radius of the North Corridor. Both sites (46MS275 and 46MS276) are reported as remnants of prehistoric mounds located approximately 0.7 mile southeast of the pipeline corridor on the Ohio River floodplain. Neither site has been evaluated for NRHP eligibility.

A Phase I survey conducted to identify archaeological sites within the potential impact areas of the pipeline corridors identified no archaeological sites (see Appendix H). In total, 595 shovel tests were excavated in Low, Moderate, and High Probability areas throughout the pipeline construction areas at 49.2-foot (15-meter) intervals along 98 survey transects. In addition, 102 judgmentally placed shovel tests were excavated in Low Probability areas. The majority of STPs in the upland portions of the survey areas displayed minimal silty and sandy loam topsoil overlaying silty and sandy clay B horizon subsoils. Shovel tests in the low-lying areas near stream crossings exhibited inflated alluvial topsoil overlaying sandy and silty B horizon subsoils. Ground disturbances observed during the survey included road crossings, built transmission line areas, and landscaping associated with domestic houses.

As a result of the survey, one isolated find (46MS365 [IF TRC-1]) was recorded. The find consists of a possible chert flake fragment recovered in a grassy agricultural field in the central portion of the South Corridor survey area. Eight radial shovel tests excavated at 6.6 and 16.4-foot (2- and 5-meter) intervals in cardinal directions surrounding the positive shovel test yielded no additional cultural material. Therefore, this isolated find does not meet the definition of an archaeological site. By letter dated January 10, 2011, WVSHPO concurred with the recommendations submitted in the Phase I survey report that this resource is not eligible for the NRHP.

Historic Resources

Research conducted at the WVSHPO indicates that no NRHP-listed or NRHP-eligible historic resources occur within a 1-mile radius of any of the pipeline corridors. There are no previously recorded architectural resources within the 500-foot APE of the pipeline corridors. An architectural survey conducted in July 2010 identified one architectural resource over 50 years old, the Nutter House (MS-0165), located at 4439 Tombleson Run Road within the APE of the Jordan East Corridor as not eligible for the NRHP (see Appendix H). The WVSHPO concurred with the NRHP-eligibility recommendation for this resource.

Native American Tribes

DOE began coordination with the Native American Tribes as discussed in Section 3.9.2.1.

3.9.2.3 Injection Well Sites

Archaeological Resources

Research conducted by DOE at the WVSHPO indicates that no NRHP-listed archeological resources or archeological resources that have been determined eligible for the NRHP occur within a 1-mile radius of the potential injection and monitoring well sites. Six archaeological sites (46MS296, 46MS297, 46MS301, 46MS302, 46MS303, and 46MS304) have been previously recorded within a 1-mile radius of Injection Well Site MT-1 at the Mountaineer Plant. The WVSHPO determined that sites 46MS296, 46MS301, and 46MS302 are ineligible for the NRHP. The remaining archaeological sites (46MS297, 46MS303, and 46MS304) have not been evaluated for NRHP eligibility.

A Phase I survey conducted to identify archaeological sites within the potential impact areas of the potential injection well sites identified no archaeological sites (see Appendix H). The injection well sites consist of approximately 55 acres of potential construction areas and access roads within five properties. Injection Well Site MT-1 at the Mountaineer Plant consists of a cleared construction area which is graded and gravel-covered. The potential construction area has been severely impacted from past and present land alteration activities. Due to the previous ground disturbance, the potential for identifying undisturbed archaeological resources in this area is unlikely, and the survey area was limited to visual inspection and photo-documentation.

The injection well sites at Western Sporn Tract (WS-1), Jordan Tract (JT-1), Borrow Area (BA-1), and Eastern Sporn Tract (ES-1, ES-2, and ES-3) are all located on upland landforms in the interior of Mason County. These landforms are typical of the broad upland and narrow ridge topography found in the region. Shovel tests on the upland landforms exhibited minimal, eroded silty and sandy loam topsoil overlaying silty and sandy clay B horizon subsoils. In total, 175 shovel tests were excavated in these potential injection well site survey areas at 49.2-foot (15-meter) intervals along 19 survey transects. No cultural material was recovered.

Historic Resources

Research conducted at the WVSHPO indicates that no NRHP-listed historic resources occur within a 1-mile radius of any of the potential injection well properties. The WVSHPO has determined that two historic resources within the APE of the Mountaineer Plant—the Graham Station School (MS-0180) on State Route 62 and the B&O Railroad (MS-0178) (Ohio River Division) —are eligible for listing in the NRHP under Criterion A. In addition, the Graham Station Baptist Church (MS-0179), on State Route 62, is within the APE of the Mountaineer Plant, but has been determined not eligible for NRHP listing by the WVSHPO in 2005. The Graham Cemetery (MS-0177), also located on State Route 62 within the Mountaineer Plant APE, was determined not eligible for the NRHP in 2011.

There are no previously recorded architectural resources within the 500-foot APE of any of the other four injection well properties. An architectural survey conducted in July 2010 to identify resources over 50 years of age identified 13 resources within the APE of the other 4 injection well properties (see Appendix H). The Lieving Farm (MS-0170), located at 2552 Lieving Road (CR 7), is NRHP-eligible under Criteria B and C, and is within the APE of the Western Sporn Tract. A section of the B&O Railroad at Letart Falls (MS-0168) is NRHP-eligible under Criterion A, and is within the APE of the Eastern Sporn Tract. The WVSHO concurred with the NRHP eligibility recommendations on the 13 resources within the APE of these sites.

Native American Tribes

DOE began coordination with the Native American Tribes as discussed in Section 3.9.2.1.

3.9.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to cultural resources based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.9.1.3.

3.9.3.1 Construction Impacts

CO_2 Capture Facility

The proposed CO_2 capture facility consists of a 33-acre construction area which has been previously disturbed. The area has been severely impacted from past and present land alteration activities. Due to previous ground disturbance, the potential for identifying undisturbed archaeological resources in this area is unlikely. As such, construction at the CO_2 capture facility would result in the disturbance of previously disturbed industrial-developed open space land. Therefore, there would be no impact to archaeological resources in this area.

There would be no adverse effect to the two historic resources identified by DOE (Graham Station School [MS-0180] and B&O Railroad [MS-0178]) from the construction of the CO_2 capture facility according to the definition of effects contained in 36 CFR 800.5 (a)(1), as there would be no apparent or measurable impacts expected.

Based on the findings of the 2005 archaeological survey at the barge unloading area and modifications that have occurred to the shoreline in this area, the potential for identifying undisturbed archaeological resources in this area is unlikely. As a result, no impacts to archaeological resources would be expected in the area proposed for the upgrades to the existing barge unloading area. Because no NRHP-listed or NRHP-eligible resources are located within the APE of the barge unloading area due to topography and intervening structures, there would be no historic resources affected by the construction of the capture facility, as defined in 36 CFR 800.5 (a)(1).

Pipeline Corridors

A Phase I archaeological survey of the pipeline corridors identified no archaeological sites. Therefore, no impacts to archaeological resources as a result of pipeline construction would be expected.

Because no NRHP-listed or NRHP-eligible resources are located within the APE of any of the pipeline corridors, there would be no historic resources affected by the construction of the pipeline, as defined in 36 CFR 800.5 (a)(1).

Injection Well Sites

A Phase I archaeological survey of the potential injection well sites did not identify any archaeological sites. Therefore, no impacts to archaeological resources as a result of construction at the injection well sites would be expected.

The construction of the injection wells would not alter the setting or other aspects of integrity of the two NHRP-eligible resources identified by the WVSHPO (Graham Station School and B&O Railroad) that contribute to their NRHP-eligibility and thus would have no adverse effect on these resources.

The construction of the wells would not alter the setting or other aspects of integrity of the two additional NRHP-eligible resources identified by DOE (Lieving Farm and Section of B&O Railroad at Letart Falls [MS-0168]) that contribute to their NRHP-eligibility and thus would have no adverse effect on these resources in accordance with 36 CFR 800.5 (a)(1).

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the characterization work. AEP anticipates the need for one to three monitoring wells per injection well, or per co-located pair of injection wells. In the event that monitoring wells would be sited on a portion of the injection well property that has not been surveyed by DOE, a Phase I archaeological survey would be conducted of any potential monitoring well site. AEP would, to the greatest extent practical, use the siting criteria presented in Section 2.3.1 to select monitoring well sites. Based on the siting criteria, it is expected that AEP would avoid any archeological resources, and related impacts would be similar to those described for the construction of the injection wells. Impacts to the NRHP-eligible resources from the construction of monitoring wells would be similar to those described for the construction of the injection wells.

3.9.3.2 Operational Impacts

CO_2 Capture Facility

A Phase I archaeological survey of the CO_2 capture facility identified no archaeological resources. Therefore, no impacts to archaeological resources during operation of the CO_2 capture facility would be expected.

There would be a negligible impact to the two historic resources identified by DOE (Graham Station School and Section of the B&O Railroad at Letart Falls [MS-0168]) from the operation of the CO_2 capture facility. The project would not introduce visual, atmospheric, or audible elements that diminish the integrity of the resource's significant historic features, nor would it change the physical features within the property's setting that contribute to its historic significance.

Pipeline Corridors

A Phase I archaeological survey of the pipeline corridors identified no archaeological sites. Therefore, no impacts to archaeological resources during operation of the pipeline corridors would be expected.

As no NRHP-listed or NRHP-eligible resources are located within the APE of any of the pipeline corridors, there would be no impacts to historic resources during operation of the pipeline corridors.

Injection Well Sites

A Phase I archaeological survey of the potential injection well sites identified no archaeological sites. Therefore, no impacts to archaeological resources during operation of the wells would be expected.

There would be a negligible impact to the two NRHP-eligible resources identified by DOE (Lieving Farm and Section of B&O Railroad at Letart Falls [MS-0168]) from the operation of the injection wells. The project would not introduce visual, atmospheric, or audible elements that diminish the integrity of the resource's significant historic features, nor would it change the physical features within the property's setting that contribute to its historic significance.

Operations of the monitoring wells would generate impacts to NRHP-eligible resources similar to those discussed for the injection wells.

3.9.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to cultural resources.

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3.10 LAND USE AND AESTHETICS

3.10.1 Introduction

This section identifies and describes existing land use and aesthetic resources potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project on these resources and addresses the compatibility of the project with current and future land uses on the project properties and vicinity. For the purpose of this analysis, aesthetic resources include scenic areas, such as public lands (e.g., national parks or forests), nature preserves, viewsheds, and other resources preserved and managed by the federal, state, and local governments. Aesthetic resources can be affected by changes in the visual landscape, increased noise, or other factors diminishing the physical value of these resources.

3.10.1.1 Region of Influence

The ROI for potential land use and aesthetic impacts includes the geographical boundaries of the proposed CO_2 capture facility (as defined in Section 2.3), potential corridors, and injection well sites. The ROI also includes the immediately adjoining properties and viewsheds. A viewshed is the land, water, and other environmental elements that are visible from a fixed vantage point.

3.10.1.2 Method of Analysis

Based on information obtained from the Mason County Commissioners Office, Mason County does not have a planning commission to oversee and manage land development and land use in areas lying outside of municipalities. Also, there are no comprehensive plans or zoning ordinances applicable to these areas. Since the Mountaineer CCS II Project would be located in unincorporated Mason County, it cannot be evaluated for compatibility with any existing land use plans, zoning ordinances, or comprehensive plans as these plans do not exist.

Therefore, land cover types and land ownership information were used to infer the current land uses in the study area. Impacts to land use were evaluated using GIS imagery to calculate direct project impacts within the Mountaineer Plant property, the pipeline corridors, and injection well sites. This section examines land use based on land cover types presented in Section 3.8, Biological Resources. Current and proposed land uses were also determined based on a site visit and the review of USDA NRCS land cover data and 2009 aerial imagery from the USDA National Agricultural Imagery Technical Center.

Aesthetic resources in the ROI were identified through aerial photography, site visits, USGS topographic maps, land use cover maps, zoning maps, and a review of local published resources. Since there are no national parks, state parks, state or national forests, recreation areas, or wildlife refuges within the study area, the analysis of impacts is focused in the ROI.

3.10.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to land use based on whether the project would

- maintain compatibility with land uses within the subject properties;
- maintain compatibility with land uses on adjacent properties; and
- result in land use restrictions on adjacent properties.

The evaluation of potential impacts to aesthetic resources considered whether the Proposed Action would directly or indirectly affect a protected resource. While there may be aesthetic qualities that are valued locally within the viewshed, federal and state laws do not typically protect unmanaged viewshed locations. However, local viewsheds and the proximity of residences to potential new structures are important to the affected parties. The analysis of aesthetic impacts considered the potential for the following effects:

- A blocked or degraded scenic vista or viewshed
- Degrading or diminishing of a federal, state, or local scenic resource
- A change in area visual resources
- Glare or illumination that would be obtrusive or incompatible with existing land use
- Creating visual intrusions or visual contrasts affecting the quality of a landscape

3.10.2 Affected Environment

3.10.2.1 CO_2 Capture Facility

The CO_2 capture facility would be sited within the existing Mountaineer Plant property, located approximately 1 mile southeast of New Haven in Mason County. Figure 2-2 shows the location of the Mountaineer Plant. Although no zoning classifications have been identified for the area, land use within the existing Mountaineer Plant property can be characterized as industrial, specifically related to coal-fired power generation. Typical coal power plant facilities include equipment, buildings, and structures related to power generation; and infrastructure for the handling and storage of coal and coal combustion by-products. The Mountaineer Plant is a heavily developed, industrial site that includes an approximately 400-foot-tall cooling tower, two approximately 1,000-foot-tall stacks on the northwest end of the property, and several other industrial structures associated with the plant.

The project would occupy approximately 33 acres within a 450-acre contiguous property owned by AEP. The entire 33-acre project area is characterized by developed open space and industrial fields associated with the plant (i.e., grassy areas). Immediately adjacent lands within the Mountaineer Plant property are also developed and contain impervious surfaces and structures associated with coal power generation. Land surrounding the Mountaineer Plant includes New Haven to the northwest, agricultural and forested areas to the west and south, and the Ohio River and Racine, Ohio to the east, across the river. There are also areas associated with mining to the south and east. The nearest residences are located approximately 2,600 feet west of the proposed location of the Mountaineer CCS II Project.

3.10.2.2 Pipeline Corridors

Potential pipeline corridors have been identified to convey the CO_2 from the Mountaineer Plant to injection well locations. As the land between the Mountaineer Plant and the injection well properties is not entirely owned by AEP, a pipeline corridor must be established and legal ROWs, setbacks, and easements must be obtained. Existing electrical transmission line corridors would be followed as much as possible to reduce the level of environmental and socioeconomic impacts that could result from establishing new ROWs. As discussed in Chapter 2, the pipelines would be sited in accordance with applicable federal and state regulations, including 49 CFR 195.210 and West Virginia Code Chapter 22 and as such, pipeline ROWs would avoid, as much as practicable, areas containing private dwellings, industrial buildings, and places of public assembly.

Table 3.8-3 (Section 3.8, Biological Resources) presents a detailed breakdown of the existing land cover along the various corridor segments using NatureServe ecological systems cover data (NatureServe, 2010). For the purposes of evaluating land use, however, the following categories are used: natural land cover (i.e., forested, riparian/floodplain and wetland); developed land/disturbed open space (i.e., transportation corridors, industrial, commercial, and residential); agricultural land (including pasture and cropland); and previously disturbed cover (including areas of former human disturbance such as land clearing and ROW). Figure 3.8-1 shows the overall distribution of land cover within the study area, including the pipeline corridors.

Several of the pipeline corridors run entirely along existing power easements, such as the North Corridor (Segments A, B, and C); the South Corridor (Segments A, B, C, and E); the Eastern Sporn Corridor; and the Jordan East Corridor. Other pipeline corridors run largely along an existing easement but include one or more short deviations, including: South Corridor Segment D, the Jordan East Corridor, and the Western Sporn Corridor. Several of the corridors, however, cross private property and include the establishment of new ROWs; these include the East Corridor (Segments A and B), Blessing Road Corridor (Segments A and B), and Foglesong Corridor.

As shown on Figure 3.8-1 (Section 3.8, Biological Resources), land use types in the vicinity of the pipeline corridors include mainly natural land cover (forest and wetland/floodplain), agricultural land (pasture), and developed/disturbed open space. Along the North Corridor, however, the pipeline would cross an area of more intensive development/disturbance associated with the Mountaineer Plant.

Land use in the region also includes rural residential properties, mining areas, and other industrial facilities. The residential properties are scattered throughout the study area (see Table 3.10-1, *Potential Pipeline Route Construction Disturbances to Land Use*, which provides the number of residential properties within 1,000 feet of the pipeline routes). The permitted mines are mapped at several locations, including: along the North Corridor (on AEP-owned land), north of the Western Sporn Corridor, and east of South Corridor Segment E. Mining areas are shown on Figure 3.8-1 and mining activities are discussed in Section 3.3, Geology.

3.10.2.3 Injection Well Sites

AEP owns the five properties identified for potential injection and monitoring well sites. Three of these properties are currently vacant and undeveloped. The following is a general summary of existing land cover at the potential injection well properties and surrounding areas (a more detailed breakdown of each property is provided in Table 3.8-4 [Section 3.8, Biological Resources]):

- **Mountaineer Plant** – Land at the potential injection well site at the Mountaineer Plant (MT-1) can be classified as developed/disturbed open space, while the land immediately surrounding it is industrial (see Figure 2-9). The nearest residence is located approximately 2,700 feet northwest of Injection Well Site MT-1.
- **Borrow Area –** The three Borrow Area properties are located approximately 2 miles south of the Mountaineer Plant. Borrow Area 1 (12 acres), Borrow Area 7 (5 acres), and Borrow Area 8 (11 acres) are all disturbed sites that were previously cleared and graded in support of AEP's landfill operations. They are generally surrounded by developed/disturbed open space to the north and forest to the south. The priority site at the Borrow Area for constructing a potential injection well is Borrow Area 8, which can also be classified as developed/disturbed open space (see Figure 2-10). The nearest residence is located approximately 3,830 feet east of BA-1.
- **Eastern Sporn Tract –** The Eastern Sporn Tract is a 400-acre parcel of land located approximately 4.5 miles south of the Mountaineer Plant. The land is undeveloped and forested. Undeveloped forested land surrounds the property to the north and south, and an area of developed/disturbed open space is located to the southeast. Most of the land area required for the potential Injection Well Sites ES-1, ES-2, and ES-3 is currently forested (see Figure 2-11). The nearest residence is located approximately 380 feet west from the midpoint of injection well sites ES-1 and ES-3.
- **Jordan Tract –** The Jordan Tract is a 170-acre parcel of land located approximately 10.5 miles south of the Mountaineer Plant. The land is mostly undeveloped and partially forested. Land within potential Injection Well Site JT-1 is mostly developed/disturbed open space. Shirley Road crosses the property and runs adjacent to JT-1. The pipeline spur and access road are also located in developed/disturbed open space in close proximity to Shirley Road (see Figure 2-12). The nearest residence is located approximately 1,210 feet south.

- **Western Sporn Tract –** The Western Sporn Tract is a 70-acre parcel of land located approximately 6 miles west of the Mountaineer Plant. The property is mostly undeveloped and mostly forested. Existing land cover at potential Injection Well Site WS-1, the pipeline, and access road includes both forest and pasture (see Figure 2-13). The nearest residence is located approximately 580 feet northeast away.

3.10.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to land use and aesthetic impacts in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.10.1.3.

3.10.3.1 Construction Impacts

CO_2 Capture Facility

As previously discussed, construction of the CO_2 capture facility within the Mountaineer Plant would not conflict with any designated zoning plans. The entire 33-acre project area is characterized as previously-disturbed, undeveloped industrial open space (grassy areas). The immediately adjacent areas are developed/disturbed lands that contain impervious surface and structures associated with coal power generation. The additional facilities proposed for construction would be compatible with those on the surrounding lands, also owned by AEP.

The construction of the CO_2 capture facility would have a negligible adverse impact on land use in the immediate area. The Mountaineer Plant property has the space and infrastructure required to support the construction of the CO_2 capture facility. Construction at the Mountaineer Plant would have a negligible impact on neighboring property owners due to the distances involved. The nearest residence is located approximately 2,600 feet west of the proposed location of the Mountaineer CCS II Project. Potential impacts on privately-owned properties during construction of the CO_2 capture facility are further described in other sections of this Chapter, particularly Section 3.11, Traffic and Transportation; Section 3.12, Noise; and Section 3.14, Human Health and Safety. Construction of the CO_2 capture facility would have a negligible impact on aesthetic resources and viewsheds in the immediate area. The project site is located at an existing power plant facility and the proposed facilities would be visually compatible with the existing Mountaineer Plant facilities.

Noise, truck traffic, and dust could be contributing factors for potential aesthetic impacts to residences located within 0.5 mile of the site; however, the closest residence to the CO_2 capture facility is nearly 0.5 mile away at 2,600 feet, such that the impacts would be negligible. The CO_2 capture facility construction site would be visible from State Route 62, impacting traffic and transportation, as discussed in Section 3.11, Traffic and Transportation. Aesthetic conditions of the residences and users along State Route 62 are not expected to experience substantial direct adverse impacts during construction due to the distance involved and the existing industrial landscape surrounding the site.

Pipeline Corridors

Construction of the pipeline corridors would have both short-term and long-term impacts on land use along all the various pipeline corridors. If it is necessary for a pipeline corridor to bisect a property, the design would include a suitable crossing of the pipeline to support vehicle crossings and maintain property owner access throughout the entire property during construction. Land within the permanent ROW would be disturbed for the excavation of pipeline trenches, and adjacent land within the temporary ROW would be disturbed for access and construction staging. Post-construction, land within the temporary ROW could revert back to its original use. As such, disturbance of the area within the entire construction easement would result in temporary loss, and possible permanent loss of small areas of natural land cover (i.e., forest, grasslands, and wetlands) and temporary loss of agricultural land along the pipeline corridor. The short-term or temporary impacts on land use during construction would include the difference between the construction ROW width (80 to 120 feet) and the permanent ROW width (50 feet).

Table 3.10-1 quantifies the acreages of potential permanent and temporary impacts to land use type as a result of construction of the various pipeline corridors to the injection well sites. The maximum width of the construction ROW (120 feet) was used to calculate the acreages of potential temporary impacts to land use as it represents a conservative upper bound.

The pipeline corridors would be located along existing HVTLs to the extent possible. Bordering properties consist mainly of undeveloped land with natural ground cover (e.g., forests, grasslands, and wetlands) and agricultural land. Following construction, the land temporarily impacted could be returned to its original condition.

Construction of the pipeline corridors would cause temporary minor to moderate aesthetic impacts to adjacent property owners, depending on their proximity to the construction easement. Table 3.10-1 identifies the number of residences located along the various pipeline routes. These impacts would be short-term and related to construction noise, truck traffic, and emissions, mainly fugitive dust.

As shown in Table 3.10-1, no loss of undisturbed natural land or agricultural land would be anticipated for the plant routing option to the injection well site at Mountaineer Plant. The highest construction disturbance (total disturbance) to undeveloped natural land cover would be expected for the Jordan Route 2; however, the acreages of total construction disturbance for the other Jordan routes are within the same order of magnitude. For agricultural land, the highest construction disturbance (total disturbance) would be expected for the Western Sporn Route and the lowest would be expected in the Borrow Area Route. Likewise, the Jordan Route 2 would result in the highest temporary loss of undisturbed natural land cover and the Western Sporn Route would result in the highest temporary loss of agricultural land.

Where pipeline construction would run along an existing HVTL easement, construction impacts would be short-term and negligible because land use within the original easement would remain as ROW. In addition, the land use on adjacent property within the temporary ROW could revert back to forest or pastureland after construction. For agricultural land, the acreages of available pastureland or cropland would be minimized during construction, and then restored after construction. While the soils within the construction ROW would be returned to production if farmed, they could be less productive due to increased compaction and some loss of soil from erosion. However, the removal and preservation of topsoil during construction and replacement after construction ceases would help buffer the impact of the construction disturbance. Impacts on potential crop production could be further reduced if construction of pipelines would occur outside the planting and growing season.

In cases when pipeline construction would require the acquisition of a new easement where none existed, construction impacts would be minor, since land use would be disrupted within the entire construction ROW, and then restored to its original use after construction. As shown on Figure 2-7 and Figure 3.8-1 (Section 3.8, Biological Resources), pipeline segments that would require the most new ROW easements include Blessing Road Corridor Segment A, East Corridor Segment A, Jordan West Corridor, and the Foglesong Corridor. Pipeline corridor options that include these segments would result in more impacts to land use, compared to routing options within existing ROW areas. The impacts would be minor and short-term for the duration of construction. The pipeline route options that include these pipeline segments include Eastern Sporn Routes 1, 3, and 4; Jordan Routes 1, 3, and 4; and the Western Sporn Route. These routes were assigned a minor resource rating on Table 3.10-1, as these new areas of ROW would cause short-term minor impacts to adjacent land uses during construction and minor long-term impacts to land use within permanent ROW areas.

As discussed earlier, there are rural residential properties scattered throughout the study area (see Table 3.10-1, *Potential Pipeline Route Construction Disturbances to Land Use*, which provides the number of residential properties within 1,000 feet of the pipeline routes). Although no residential land or residential structures would be directly impacted during construction of the pipeline corridors, there are residences near the various pipeline routes. Table 3.10-1 identifies the approximate number of residences within an estimated 1,000 feet of a given pipeline route option. Construction impacts to residential land use would be driven by concerns such as those relating to dust, traffic, and noise (see Section 3.1, Air Quality and Climate; Section 3.11, Traffic and Transportation; and Section 3.12, Noise).

Injection Well Sites

Construction of the injection wells would have temporary impacts on land use due to clearing of vegetation, equipment movement, and construction of the wells. Each injection well site would require approximately 5 acres for drilling activities during construction (including temporary lay-down areas, water management, etc.). As shown on Table 3.8-6 (Section 3.8, Biological Resources), construction at the injection well sites would disturb mostly undeveloped natural land cover (i.e., forests, grasslands, and wetlands).

In general, construction of the pipeline spurs (the final length of pipeline within the injection well property) and access roads would result in temporary negligible impacts to land use at each of the injection well properties. These project features are all located within the limits of each of the injection well properties, which are owned by AEP. As shown on Tables 3.8-7 and 3.8-8 (Section 3.8, Biological Resources), construction of the pipeline spurs and access roads would disturb mostly undeveloped land with natural land cover.

Minor and temporary impacts (i.e., construction noise) to nearby residential properties would be expected. The nearest residences to the injection well sites at Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract are 380 feet, 1,210 feet, and 580 feet, respectively. The structures constructed at the injection well sites would likely be less than 10 feet in height. The construction equipment and drill rigs would extend higher, but would not remain on the site after construction has been completed. Construction activities would be visible to few residences, if any, and would generally have minor, short-term impacts. Construction impacts to residential land use would include an increase in dust, traffic, and noise (see Sections 3.1, Air Quality and Climate; 3.11, Traffic and Transportation; and 3.12, Noise, respectively).

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the geologic characterization study. AEP anticipates the need for one to three monitoring wells per injection well, or per co-located pair of injection wells. Impacts to land use and aesthetics from monitoring well construction would be similar to those described for the construction of the injection wells.

3.10.3.2 Operational Impacts

CO_2 Capture Facility

The operation of the CO_2 capture facility would have a negligible impact on the industrial land use within the Mountaineer Plant property. The CO_2 capture facility would be compatible with land use of the immediately surrounding lands, also owned by AEP. Operation of the CO_2 capture facility would also have a negligible impact on neighboring property owners due to the distances involved. The nearest residences are located approximately 2,600 feet from the CO_2 capture facility. Potential impacts on residential properties during operation are described in other sections of this Chapter, particularly Section 3.11, Traffic and Transportation; Section 3.12, Noise; and Section 3.14, Human Health and Safety.

Table 3.10-1. Potential Pipeline Route Construction Disturbances to Land Use

Potential Injection Well Property	Pipeline Route Options	Resource Impact Type (acres unless otherwise noted)								Resource Impact Rating
		Permanent Loss of Natural Land Cover (forests, grasslands, etc.)	Temporary Loss of Natural Land Cover (forests, grasslands, etc.)	Total Construction Disturbance to Natural Land Cover Grassland and Shrub/Scrub	Permanent Loss of Agricultural Land	Temporary Loss of Agricultural Land	Total Construction Disturbance to Agricultural Land	Number of Residences within 1,000 feet of the Pipeline Route	Length of New ROW Created (miles)	
Mountaineer Plant	Plant Routing								0	Negligible
Borrow Area	Borrow Area Route	9.8	14.1	23.9				0	0	Negligible
Eastern Sporn Tract	Eastern Sporn Route 1	24.9	35.2	60.1	1.1	1.4	2.5	2	0.66	Minor
	Eastern Sporn Route 2	45.1	65.2	110.3				12	0.18	Negligible
	Eastern Sporn Route 3	23.6	33.4	57.0	3.0	4.0	7.0	5	1.54	Minor
	Eastern Sporn Route 4	43.5	62.5	106.0	4.0	5.4	9.4	16	1.56	Minor
Jordan Tract	Jordan Route 1	50.8	73.2	124.0	0.3	0.4	0.7	11	1.02	Minor
	Jordan Route 2	51.2	73.5	124.7	0.1	0.2	0.3	11	0.34	Negligible
	Jordan Route 3	49.1	70.7	119.8	4.3	5.8	10.2	15	2.41	Minor
	Jordan Route 4	49.4	70.8	120.2	4.1	5.6	9.7	15	1.73	Minor
Western Sporn Tract	Western Sporn Route	48.1	13.8	61.9	3.7	8.8	12.5	42	1.19	Minor

Note: Shaded cells indicate the resource was not determined to be present.
ROW = right-of-way

Long-term direct effects to existing viewsheds would primarily occur from a permanent change in the landscape resulting from the introduction of new industrial structures and facilities. The CO_2 capture facility would not substantially alter the landscape in the area. The tallest proposed structure, the absorber, would be approximately 250 feet in height. The facility would also include two new cooling towers, which could each be approximately 70 feet tall. The current Mountaineer Plant is a heavily developed, industrial site that includes an existing 400-foot-tall cooling tower, two approximately 1,000-foot-tall stacks, and several other industrial structures.

Due to the terrain and low groundcover, a number of residential properties would have a nearly unobstructed view of the industrial features of the Plant and could experience aesthetic impacts in the range of negligible to minor. Overall impacts, however, would be negligible as the existing large structures at the Mountaineer Plant are contributing factors to the existing viewshed of these residences. All proposed new structures would be considerably shorter than the existing emission stacks and cooling tower, which currently exist on the Mountaineer Plant property. To the extent practicable, the project design would incorporate landscaping techniques to further reduce potential visual and audible impacts on surrounding property owners.

Pipeline Corridors

Long-term impacts to land use would occur from the permanent conversion of natural land cover in some areas (i.e., forest, grasslands, and wetlands) and agricultural land in others to pipeline corridors. As summarized in Table 3.10-1, the acreages of permanent ROW required for the potential pipeline corridors would vary according to which pipeline route option is selected. The highest permanent loss of natural ground cover would occur with the Jordan Route 2 and the lowest permanent loss of natural ground cover would occur with the Borrow Area Route. The highest loss of agricultural land would occur with the Jordan Route 3 and lowest loss of agricultural land would occur with the Jordan Route 2.

Operation of the pipeline corridors would have negligible long-term impacts to pastureland. Any potential impacts would be mitigated by allowing the current land use to resume after construction, provided that there is adherence to ROW restrictions that allow access for maintenance and limit construction of permanent structures within the permanent pipeline easement. For pasture and cropland, therefore, long-term impacts on agricultural use within pipeline corridors would likely be less than the acreages shown in Table 3.10-1 as permanent ROWs. Impacts on potential crop production could be further minimized if maintenance activities within the pipeline corridors could be performed outside the planting and growing seasons.

Where pipeline construction would run along an existing ROW, long-term impacts to land use would be negligible, since land use within the original easement would remain as permanent ROW. However, where new ROW would be created along a given pipeline corridor, the long-term impact to land use would be minor. Land that is currently forest would be permanently changed to ROW and land use would be subject to restrictions within the permanent easement for the pipeline. Pipeline corridors may cross private properties and impact land use options within the permanent easement. In cases where a new pipeline corridor would bisect a property, impacts could occur if the pipeline would obstruct current or future access within the property (i.e., road crossings and vehicle access). This impact, however, would be unlikely as the pipeline would be placed underground and engineered to withstand the weight of typical residential or rural vehicles (i.e., cars, trucks, tractors).

As shown on Figure 2-7 pipeline segments that would require the most new ROW include Blessing Road Corridor Segment A, East Corridor Segment A, Jordan West Corridor, and the Foglesong Corridor. Pipeline routing options that include these segments would result in more long-term impacts to land use. The impacts would be minor since the easements would be obtained through consent of the property owner. Also, the Blessing Road Corridor Segment A and the Foglesong Corridor occur next to existing roadways so the creation of a permanent easement would not significantly alter the impacted properties. The pipeline routing options that include these pipeline segments include Eastern Sporn Routes 1, 3, and

4; Jordan Routes 1, 3, and 4; and the Western Sporn Route. Thus, these routes were assigned a minor resource impact rating on Table 3.10-1.

As discussed earlier, there are rural residential properties scattered throughout the study area (see Table 3.10-1, *Potential Pipeline Route Construction Disturbances to Land Use*, which provides the number of residential properties within 1,000 feet of the pipeline routes). Although no residential land or residential structures would be directly impacted during construction of the pipeline corridors, residences are present near the various pipeline routes. Table 3.10-1 identifies the approximate number of residences within an estimated 1,000 feet of a given pipeline route option. Potential impacts would be minimized through conformance with pipeline siting regulations. Potential long-term impacts to residential land use during operations are also discussed in Section 3.14, Human Health and Safety.

Since the potential pipeline would be predominantly buried, and the land returned to its previous use, negligible long-term impacts to scenic resources from pipelines would occur. Aesthetic impacts to the adjacent property owners from operation of the pipeline segments would be characterized as negligible to minor. As previously discussed, the pipeline routing options that include the creation of new permanent ROW would cause the most impacts to adjacent property owners; however, these impacts would remain minor as the pipeline would be predominantly buried. The placement of underground utility signs along the pipeline corridors would have minor impacts to aesthetics in locations of newly established ROW.

Injection Well Sites

Operation of the injection well sites and use of the pipeline spurs and access roads would result in the potential permanent loss of forests and grasslands at some locations (see Tables 3.8-6 through 3.8-8 in Section 3.8, Biological Resources). The impact on land use in the immediate area would be negligible since AEP owns all the properties under consideration and no conflicts would be expected with other intended land uses on the properties. Each injection well site would occupy a 0.5-acre site, which would be located as close as possible to available public roads to minimize the length of an access road necessary for maintenance vehicles.

For land use in the surrounding areas, the potential long-term impact of operations at the injection well sites would also be negligible to minor. Since all the injection well properties are situated outside of municipalities in Mason County, and no existing zoning plans or ordinances exist for these areas, the potential use of the properties would cause negligible impacts to zoning and ordinances. Operation of the Injection Well Sites at the Mountaineer Plant (MT-1) and the Borrow Area (BA-1) would have minor impacts on the industrial land uses characterizing each area.

Operation of the injection well sites at the Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract would have negligible to minor impacts to neighboring residential property, depending on their respective proximity to the facilities. Potential long-term impacts to residential land use during operations of the injection well sites are also discussed in Section 3.14, Human Health and Safety.

Since the potential injection wells, pipeline spurs, and access roads associated with the project are all located within AEP-owned property, no conflicts with visual receptors at the site would be expected. Natural ground cover outside of the properties would remain and provide screening to minimize aesthetic impacts. Farming on the land surrounding the injection well sites, if present, would continue and would also provide additional screening during the growing season. Thus, the wells could create a direct, minor visual intrusion for closest receptors primarily in the fall after harvest, during the winter, and in the spring before crops achieve their full growth.

There are no residences in close proximity to Injection Well Site MT-1 at the Mountaineer Plant and BA-1 at the Borrow Area. The nearest residences to the injection well sites at the Eastern Sporn Tract, the Jordan Tract, and the Western Sporn Tract are at distances of approximately 380 feet, 1,210 feet, and 580 feet, respectively. Due to the relatively short height of the structures at the injection well sites, residential receptors should not experience any adverse visual effects from the well structures.

Operations of the monitoring wells would generate impacts to land use similar to those discussed for the injection wells. Each monitoring well would be expected to require 0.5 acre during operations.

3.10.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to land use and aesthetic resources.

3.11 TRAFFIC AND TRANSPORTATION

3.11.1 Introduction

This section identifies and describes traffic and transportation systems potentially affected by the construction and operation of the Mountaineer CCS II Project, and analyzes the potential effects from this project on these systems. Specifically, this section analyzes the ability of existing traffic and transportation infrastructure to meet the needs of the project while continuing to meet the needs of other users.

3.11.1.1 Region of Influence

The ROI for traffic and transportation includes primary roadways, the rail line, and the barge handling facilities that would serve the Mountaineer CCS II Project, including the Mountaineer Plant, pipeline corridors, and injection well sites. With respect to roadways, the quantitative analysis of traffic impacts was limited to a 20-mile corridor on State Route 62. State Route 62 would constitute a key corridor for commuting workers and the transportation of materials and machinery to the potential sites. Therefore, State Route 62 would experience the majority of the new traffic volumes. Impacts to local, small connector roads that would serve the pipeline corridors and injection well sites and rail lines and barge facilities that would serve the Mountaineer CCS II Project are discussed qualitatively.

3.11.1.2 Method of Analysis

DOE analyzed impacts on the roadway network within the ROI based on the following elements:

- Geographic distribution of travel patterns of workers and truck transport of materials to and from the potential sites
- Baseline traffic volumes
- "No-Build" scenario traffic volumes – projected future traffic volumes without the project
- "Build" scenario traffic volumes – projected future traffic volumes with the project

Components of the project that would impact transportation resources include the number of personnel, as well as the volume of trucks transporting materials and wastes, during the construction and operation phases. The impact analysis assumed that State Route 62 would represent a major transportation corridor for workers commuting to the potential sites, as this is a principal arterial road that connects the smaller towns throughout the northern portion of Mason County to other major state highways. The transport of materials and by-products is also expected to mainly occur on State Route 62.

DOE reviewed the 2007 average daily traffic (ADT) volumes obtained from the WVDOT. DOE estimated the number of vehicle trips[1] generated during the peak construction period (2014) and first full year of operation (2016) of the project for both the No-Build and the Build scenarios based on project information provided by AEP. This information included the anticipated total number of personnel required for each construction phase, the projected amounts of materials required and wastes generated, and the proposed size and type of activities that would occur at the Mountaineer Plant, pipeline corridors, and injection well sites. DOE used the peak morning and afternoon traffic hours to estimate the highest level of potential impacts for each phase of the project. DOE then determined the level of operating conditions on key roadway corridors using traffic volumes during the peak traffic hours and the planning methods outlined in the Transportation Research Board's *2000 Highway Capacity Manual* (TRB, 2000). This manual is an industry standard for analyzing traffic conditions.

1 A vehicle trip is defined as a one-directional trip, with a single roundtrip corresponding to two vehicle trips.

The Highway Capacity Manual establishes a scale for the level of service (LOS) of a road or intersection. The LOS scale consists of six levels. This scale qualitatively measures the operational conditions within a traffic flow and the perception of these conditions by motorists. The six levels are given letter designations ranging from A to F, with "A" representing the best operating conditions (free flow, little delay) and "F" the worst (congestion, long delays). Various factors influence the operation of a roadway or intersection, including speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. No LOS standards exist in the project area; however, LOS designations of A, B, or C are typically considered good operating conditions, in which motorists experience minor or tolerable delays.

For this analysis, DOE used the volume-to-capacity (V/C) ratio to determine the LOS of roadway segments. DOE calculated this value using methodologies outlined in the Highway Capacity Manual. Table 3.11-1 summarizes the operating conditions associated with each LOS designation and the corresponding ranges of the V/C ratios for roadway segments.

Table 3.11-1. Volume-to-Capacity Ratio and LOS Designations for Roadway Segments

LOS	Operating Conditions	Volume-to-Capacity Ratio for a Two-Lane Highway
A	Free flow traffic with individual users virtually unaffected by the presence of others in the traffic stream.	0.0-0.12
B	Stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users.	0.13-0.24
C	Restricted flow which remains stable but with significant interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.	0.25-0.39
D	High-density flow in which speed and freedom to maneuver are severely restricted and comfort and convenience have declined even though flow remains stable.	0.40-0.62
E	At capacity; unstable flow at or near capacity levels with poor levels of convenience and comfort and very little, if any, freedom to maneuver.	0.63-1.00
F	Forced traffic flow in which the amount of traffic approaching a point exceeds the amount that can be served. LOS F is characterized by stop-and-go waves, poor travel times, low comfort and convenience, and increased accident exposure.	>1.00

Source: TRB, 2000
LOS = level of service

DOE qualitatively analyzed impacts related to the potential use of rail and barge transport by comparing the increase in rail and barge traffic volumes to existing volumes and evaluating potential impacts from the increased usage to other users.

3.11.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to traffic and transportation based on whether the Mountaineer CCS II Project would directly or indirectly

- alter road and intersection infrastructure;
- alter traffic patterns or circulation movements;
- increase traffic volumes so as to degrade LOS conditions to unacceptable levels (e.g., increase traffic delays and cause significant congestion) and result in major safety concerns;
- increase rail traffic compared to existing conditions on railways and result in significant delays to motorists during train pass-bys at at-grade crossings; or
- conflict with local or regional transportation plans.

3.11.2 Affected Environment

3.11.2.1 Regional and Local Roadway System

The transportation infrastructure within the ROI includes federal, state, and local county primary and secondary highways and roads; a CSX Transportation rail line; and a nearby barge unloading area on the Ohio River. The Mountaineer Plant is located just southeast of New Haven in the western part of West Virginia, near the state's border with Ohio. The closest metropolitan areas include Charleston, West Virginia (65 miles southeast); Cincinnati, Ohio (160 miles west); Columbus, Ohio (105 miles northwest); and Pittsburgh, Pennsylvania (210 miles northeast). State and county roadways within Mason County are under WVDOT's jurisdiction. Interstate 77 is the closest interstate, located approximately 25 miles east of the Mountaineer Plant. A review of WVDOT's State Transportation Improvement Plan for fiscal years 2010 through 2015 (WVDOT, 2009) did not indicate any major improvement projects in the ROI and no other local or regional transportation plans were identified. Figure 3.11-1 provides an overview of the primary roadways in the ROI.

State Route 62 provides direct access to the Mountaineer Plant and to the smaller connector roads that provide access to the pipelines and injection well sites. In the ROI, State Route 62 is a paved, two-lane highway. The closest bridge that provides access across the Ohio River from State Route 62 is located approximately 7 miles northwest of the Mountaineer Plant.

Traffic volumes in the ROI are typical of rural areas – generally, these roadways experience relatively low traffic volumes and minor roadway congestion. However, traffic volumes in the region increase during regularly scheduled outages that occur every other year at the Mountaineer and Sporn plants. Depending on the scope, approximately 25 to 400 additional workers are located onsite during an outage, which can last from 4 to 8 weeks. Most outages are scheduled on five 8-hour shifts, but some require six 12-hour double shifts. These activities result in higher traffic volumes and temporarily increase traffic delays and congestion during the peak commute hours, which can degrade the LOS on State Route 62 by one level, depending on the number of workers. The Mountaineer Plant currently experiences approximately 7,500 deliveries from heavy delivery trucks each year. Figure 3.11-2 presents the 2007 ADT volumes obtained from WVDOT for the ROI and identifies the locations on State Route 62 analyzed as part of this EIS's traffic study.

Table 3.11-2 lists the 2007 ADT volumes and calculated LOS designations for the study locations. To better reflect the operating conditions of a roadway, DOE determined traffic volumes during the peak hour and in the predominant direction of travel (i.e., the one-way peak hour volume). For rural two-lane highways, the peak hour volume is, on average, 15 percent of the ADT (University of Idaho, 2003) and the directional split is typically 60:40 (TRB, 2000); therefore, the one-way peak hour volume was estimated by multiplying the ADT by 15 and 60 percent. The one-way peak hour volume was then used in the V/C ratios. DOE calculated the LOS designations using the V/C ratio and methodology outlined in the Highway Capacity Manual. The LOS analysis indicates that State Route 62 within the ROI is currently operating at what are typically considered good conditions (at an LOS of C or better).

3.11.2.2 Rail and Barge Transportation

The CSX Transportation rail line services the ROI. One public at-grade rail crossing is located within the ROI in New Haven at Midway Drive. Currently, the Mountaineer Plant receives approximately 400 railcar deliveries of material in a year, which is equivalent to four unit (100 cars/unit) trains. According to the Federal Railroad Administration, this rail crossing experiences approximately eight train pass-bys per day. The crossing includes warning signs, but no activated gate signaling (i.e., no mechanical arms or flashing lights) (FRA, 2010).

Figure 3.11-1. Regional Transportation System

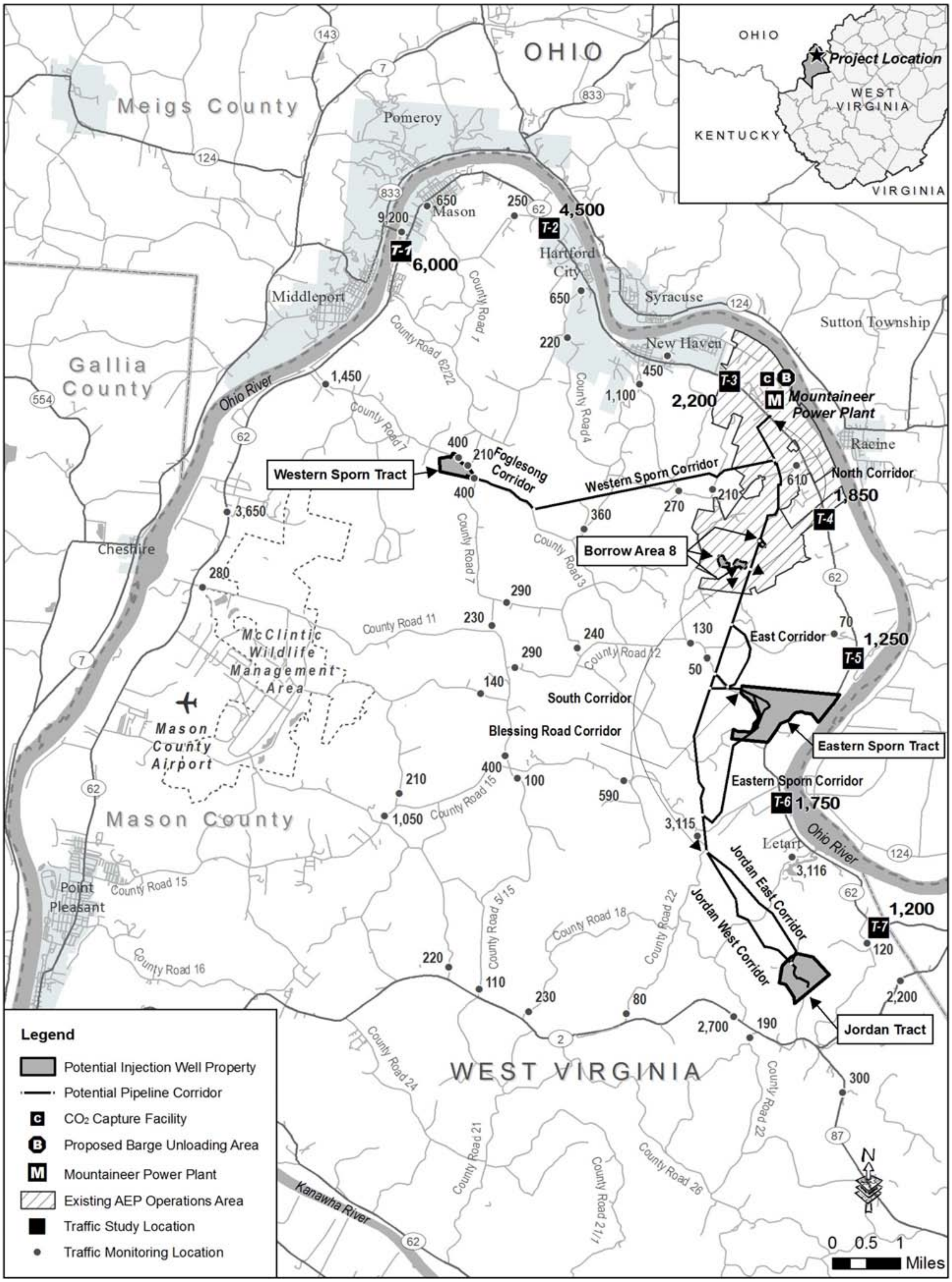

Figure 3.11-2. Average Daily Traffic Volumes in the ROI (WVDOT, 2007)

Table 3.11-2. Traffic Volumes and LOS on State Route 62

Study Location on State Route 62	2007 Average Daily Traffic[a]	One-Way Peak Hour Volume[b]	V/C[c]	LOS[d]
T-1	6,000	540	0.37	C
T-2	4,500	405	0.28	C
T-3	2,200	198	0.14	B
T-4	1,850	167	0.11	A
T-5	1,250	113	0.08	A
T-6	1,750	158	0.11	A
T-7	1,200	108	0.07	A

[a] WVDOT, 2007
[b] One-way peak hour volume = directional distribution (60 percent) x peak hour volume (15 percent of ADT).
[c] V/C = volume-to-capacity ratio, where V = one-way peak hour volume and C = lane capacity (1,700 vehicles per hour) x peak hour factor (0.88 for rural roads); LOS = level of service
[d] See Table 3.11-1for descriptions of level of service designations.

A coal and limestone unloading area for the AEP Mountaineer Plant is located on the Ohio River shoreline. This facility is owned and operated by AEP and provides a platform to unload equipment and material from barges. The plant receives approximately 3,000 barges of coal and limestone in a year, which is equivalent to 200 barge deliveries per year (assuming 15 barges in a single tow or delivery).

3.11.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to traffic and transportation in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.11.1.3.

3.11.3.1 Construction Impacts

Construction and commissioning of the project would take approximately 32 months, beginning in early 2013. Construction equipment, materials, and wastes would mainly be transported by trucks via State Route 62, though a small number of deliveries could also be made by rail and barges.

The primary impact on the regional transportation system would be from workers commuting to and from the project sites on a daily basis. The increase in commuter vehicles could lead to noticeable traffic congestion and delays to local motorists during peak morning and afternoon hours, but would be temporary, and similar to past construction project and outage work at the Plant, lasting only the duration of the 32-month construction and commissioning period. The transport of materials and wastes and construction workers commuting to the project sites would generate an increase in traffic volumes primarily on State Route 62.

Using the WVDOT 2007 ADT data, DOE projected 2014 No-Build and Build ADT volumes by assuming a 0.3 percent annual (non-project) increase. DOE used the year 2014, as this year would represent peak proposed construction conditions and construction-related traffic and, therefore, this analysis represents an upper bound for traffic impacts. DOE estimated V/C ratios and LOS designations for the daily peak hours in 2014, as most of the project-related vehicles (from construction workers commuting) would occur during these time periods. Because the majority of vehicles would mainly access the project sites from State Route 62, DOE evaluated traffic impacts for key segments on State Route 62, as shown in Figure 3.11-2. Anticipated project-related traffic volumes for each of the project components are discussed below, followed by the results of the combined traffic analysis. The daily and peak hourly traffic volumes and the projected percent increases in volumes on State Route 62 are presented in Table 3.11-3.

Table 3.11-3. Traffic Volumes and LOS for 2014 No-Build and Build Conditions

Study Location on State Route 62	2014 No-Build			2014 Build				
	No-Build ADT[a]	One-Way Peak Hour Volume[b]	V/C[c,d] and LOS	Percent of New Car Trips Passing through Location[e]	Percent of New Truck Trips Passing through Location[f]	Build ADT[g] and [percent increase]	One-Way Peak Hour Volume[h] and [percent increase]	V/C[c,d] and LOS
T-1	6,127	551	0.37 C	45	50	6,941 [13]	933 [69]	0.62 D
T-2	4,595	414	0.28 C	60	50	5,658 [23]	920 [122]	0.61 D
T-3	2,247	202	0.14 B	70	50	3,476 [55]	792 [291]	0.53 D
T-4	1,889	170	0.11 A	70	50	3,118 [65]	759 [347]	0.51 D
T-5	1,276	115	0.08 A	60	50	2,339 [83]	621 [441]	0.42 D
T-6	1,787	161	0.11 A	0.45	50	2,601 [46]	543 [237]	0.36 C
T-7	1,225	110	0.07 A	0.40	50	1,956 [60]	451 [309]	0.30 C

[a] Assumed traffic rate increase was 0.3 percent per year.
[b] One-way peak hour volume for 2014 No-Build = directional distribution (60 percent) x peak hour volume (15 percent of ADT).
[c] V/C = volume-to-capacity, where V = one-way peak hour volume and C = lane capacity (1,700 vehicles per hour) x peak hour factor (0.88 for rural roads); ADT = average daily traffic; LOS = level of service.
[d] See Table 3.11-1 for descriptions of level of service designations.
[e] These values are based on the geographic distribution of commuter routes and represent the percent of the number of new car trips that could pass through the location.
[f] These values represent the percent of the number of new truck trips that could pass through the location. Because the truck routes are unknown at this time, it was assumed that 50 percent of the truck trips would pass through each study location (assumed that half of the trucks would travel in either direction on State Route 62).
[g] 2014 Build ADT = (2014 No-Build ADT) + (percent of new car trips passing through location x 1,660 car trips/day) + (percent of new truck trips passing through location x 134 truck trips/day).
[h] 2014 Build One-Way Peak Hour Volume = [2014 No-Build One-Way Peak Hour Volume] + [(1,660 car trips/day) / (2 peak hours/day) x (percent of new car trips passing through location)] + [(134 truck trips/day) / (8 hours/day) x (percent of new truck trips passing through location)].

CO_2 Capture Facility

The largest demand for construction workers is expected to occur in the latter half of 2014, when this demand would consistently range from 600 to 800 persons. In the later months of the construction phase, the average number of workers would range from 50 to 100 construction workers at a time. Assuming 20 percent of commuters would carpool to the construction site, DOE estimates that the total number of vehicle trips (i.e., one way trips) from construction workers during the peak construction months would average around 1,300 vehicle trips per day.

Depending on the amount of equipment and material needed, construction of the CO_2 capture facility could generate approximately 20 to 90 deliveries per month by truck. The most frequent deliveries (60-90 per month) are expected to occur from October 2013 to October 2014. DOE estimates that during the peak construction months, the number of truck trips (i.e., transporting equipment and materials) would average approximately 18 per day. Construction could also require a total of approximately four railcar deliveries over a 1-month span (in 2014) and 10 barge deliveries over a 2-month span (in 2014). The project could include up to 30 barge shipments during the construction period. State Route 62 would experience congestion and degradation of LOS during the peak commute hours.

Pipeline Corridors

The construction of one pipeline route would require approximately 25 workers at any given time, which would result in approximately 40 vehicle trips per day (i.e., assuming a 20-percent carpool rate). DOE expects truck transport of pipeline equipment and materials or wastes to the pipeline construction location would average approximately four truck trips per day.

Access to the pipeline construction sites would come from various existing roadways at the points that they are crossed by the potential corridor. Most construction traffic would use temporary ROWs for construction. Typical pipeline or roadway construction techniques would be employed, and DOE expects that although temporary lane closures may be required, all public roadway traffic would be maintained during construction. If required, traffic from each direction could be alternated at regular intervals along the open lane to avoid significant delays. To minimize traffic safety hazards, the construction contractor would provide appropriate signage alerting and instructing traffic, barricades around the construction zone, and a flagger at either end of the construction zone. Construction crews could use trenchless construction methods to cross existing roads (e.g., directional boring) in order to avoid major traffic disruption on those roadways. While there could be some congestion in the local area surrounding the construction site, relatively minor traffic impacts would be expected, given the existing low daily traffic volumes on the local connector roads within the vicinity of the pipeline routes (see Figure 3.11-2).

Injection Well Sites

Site preparation and construction at each injection well site would require approximately 25 workers at any given time, resulting in approximately 40 vehicle trips per day. For any given construction day, the number of trucks required to transport brine water would average around six trips per day. The transport of miscellaneous materials and equipment would add another eight trips per day to each site, for a total of up to 14 truck trips daily per injection well site.

Public roadway improvements would not be required for accessing the Jordan and Borrow Area properties. Although a formal evaluation has not yet been completed, it is likely that improvements would be needed to existing roadways leading up to the Eastern Sporn and Western Sporn Tracts to accommodate drilling rigs and support equipment. AEP would coordinate with WVDOT and local authorities to obtain all necessary approvals required to implement the appropriate roadway improvements. It is assumed that any required work would occur prior to any construction activities at the injection well sites to ensure that the necessary transportation infrastructure is in place to support the number and types of vehicles expected to access the sites during the construction and operation phases. As shown in Figures 2-9 through 2-13, newly constructed access roads would extend to each injection well site from existing, adjacent public roads. Access roads would have permanent widths of 12 to 15 feet. The access roads would have the ability to accommodate trucks weighing up to 40 tons. While there could be some congestion on local roads leading up to the injection well sites, minor traffic impacts would be expected, given the low existing daily traffic volumes on these local connector roads (see Figure 3.11-2).

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the characterization work. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. Related impacts to traffic and transportation would be similar to those described for the construction of the injection wells.

Combined Traffic Impacts during the Construction Phase

The following summarizes the number of vehicle trips by project component:

- CO_2 capture facility: 1,300 car trips/day and 18 truck trips/day
- Potential pipeline corridors: 40 car trips/day and 4 truck trips/day
- Potential injection well sites: 40 car trips/day and 14 truck trips/day per well

To determine the maximum potential traffic impacts, DOE assumed that construction of the CO_2 capture facility, one pipeline route, and eight wells would occur simultaneously. Therefore, a combined maximum daily traffic volume from the project would consist of up to 1,660 car trips and 134 truck trips during peak construction conditions. Table 3.11-3 presents the projected 2014 peak hourly traffic volumes (for one-direction) and LOS designations under the Build (with project) and No-Build (without project) scenarios. These volumes represent the upper bound for traffic volumes, when construction is expected to be at its peak.

Moderate, short-term vehicular traffic impacts during construction are expected. Construction could generate approximately 20 to 90 deliveries per month by truck, which represents a 3- to 16-percent increase above current truck delivery volumes to the Mountaineer Plant. This increase would be temporary, with most frequent deliveries (60-90 per month) expected to occur from October 2013 to October 2014. With the relatively high proposed number of daily car trips during peak hours, the number of construction workers would constitute the greatest traffic impact. As shown in Table 3.11-3, the number of vehicle trips could result in a 69 percent to a 441 percent increase in peak hour traffic volumes. This would degrade LOS designations on segments of State Route 62 by one to three levels and result in some traffic congestion during the peak hours, especially near the Mountaineer Plant. A change to the roadway's conditions from one of stable flow (LOS A to C) to one approaching unstable flow (LOS D) could occur and be inconvenient for travelers on parts of State Route 62, but would still be considered acceptable for a temporary condition during construction. The impact would affect only the peak hours and be expected to occur mainly during the peak construction period, when the number of workers would be the greatest (i.e., latter part of 2014). Furthermore, impacts on State Route 62 would not differ greatly from impacts that occur during regularly scheduled outages that occur every other year at the Mountaineer and Sporn plants, when up to 400 additional workers are located onsite for about 4 to 8 weeks. The following measures would be incorporated as part of the Proposed Action to minimize impacts:

- Maintain public roadway traffic during construction.
- Provide appropriate signage alerting and instructing traffic, barricades around the construction zone, and a flagger at either end of the construction zone within road ROWs that require temporary lane closures.
- If required, alternate traffic from each direction at regular intervals as needed along the open lane to avoid significant delays.
- To the extent practicable, use trenchless construction methods across existing roads (e.g., directional boring) to avoid major traffic disruption on those roadways.
- Stage construction across driveways so that vehicle access to property is maintained at all times.

To further reduce traffic impacts on State Route 62 during peak construction periods, AEP would provide traffic guards, as necessary, during workday start and end times to manage traffic flow to and from the site and encourage carpooling to limit the number of daily car trips.

During the construction period, four rail deliveries and up to 30 barge deliveries are expected to result in minor impacts to transportation resources as the number of deliveries is relatively low compared to current conditions (approximately 1 percent increase) and would be temporary.

3.11.3.2 Operational Impacts

The operational phase of the project would generate new traffic volumes on State Route 62, primarily from commuters and trucks traveling to and from the Mountaineer Plant (i.e., the CO_2 capture facility).

Using the WVDOT 2007 ADT data, DOE projected 2016 No-Build and Build ADT volumes by assuming a 0.3 percent annual (non-project) increase based on recent county population data (Census, 2010). DOE used the year 2016, as this year represented the first full year of operation of the CO_2 capture facility. DOE estimated V/C ratios and LOS designations for the daily peak hours (assumed to be during peak morning and afternoon commute periods) in 2016, as most of the project-related vehicles (from workers commuting) would occur during these time periods. Because the majority of vehicles would mainly access the project site from State Route 62, DOE evaluated traffic impacts for key segments on State Route 62, as shown in Figure 3.11-2. Anticipated project-related traffic volumes for each of the project components are discussed below, followed by the results of the combined traffic analysis. The daily and peak hourly traffic volumes and the projected percent increases in volumes on State Route 62 are presented in Table 3.11-4.

CO_2 Capture Facility

A proposed increase of 38 full-time employees would result in approximately 90 additional car trips per day (assuming 20 percent would carpool and additional vehicle trips would be generated by visitors). DOE has conservatively estimated the following daily truck transport rates of materials and wastes:

- Reagent (aqueous ammonia) – four trips per day (if anhydrous ammonia is used, then the number of daily trips would be approximately two trips per day) (note that rail-cars may be used to transport aqueous and anhydrous ammonia)
- Sulfuric acid – two trips per day (note that rail-cars may be used to transport sulfuric acid)
- Ammonium sulfate byproduct – four trips per day
- Miscellaneous waste streams (e.g., solid waste and wastewater sludge) – two trips per day; and
- Miscellaneous (e.g., service vehicles) – two trips per day

Truck deliveries of materials and removal wastes for the CO_2 capture facility would, therefore, result in up to 14 truck trips per day.

Pipeline Corridors and Injection Well Sites

DOE estimates that approximately one to two employees would conduct maintenance checks of the injection well sites two times per day. If these staff visited each site, they could undertake four additional car trips per day. The transport of wastewater during maintenance activities at the injection well sites would also generate truck trips; however, this is expected to occur infrequently and would generate a low volume of daily truck trips.

Combined Traffic Impacts during the Operation Phase

A combined daily traffic volume would consist of up to 94 car trips (90 from the CO_2 capture facility and 4 from maintenance checks at the injection well sites) and 14 truck trips (from the CO_2 capture facility). Table 3.11-4 presents the projected 2016 peak hourly traffic volumes (for one-direction) and LOS designations under the Build (with project) and No-Build (without project) scenarios.

Overall, traffic volumes during the operation of the project could result in long-term, minor impacts to baseline roadway conditions. As Table 3.11-4 shows, the number of additional vehicle trips would increase the peak hour volumes by 4 to 25 percent. The estimated 2016 Build peak hour traffic volumes would not result in any major traffic impacts on State Route 62, as the LOS values estimated for the worst-case scenario would be similar to the No-Build scenario LOS values. DOE expects segments of State Route 62 to remain at LOS C or better with implementation of the project.

Depending on the final decision on mode of transport, delivery of anhydrous ammonia (or aqueous ammonia) and sulfuric acid to the project would increase rail traffic by up to 40 shipments per year of anhydrous ammonia (or up to 100 shipments of aqueous ammonia) and 40 railcar shipments of sulfuric acid per year, and is expected to result in minor impacts to the existing rail infrastructure. Assuming the new facility would use aqueous ammonia (for an upper bound impact) and use rail transport for the aqueous ammonia and sulfuric acid (for a total of up to 140 rail shipments per year), this would contribute to approximately three additional rail shipments (or six additional train pass-bys) in any given week. Compared to the existing rail traffic volume (approximately eight train pass-bys per day or 56 train pass-bys per week), this additional traffic represents a minor (approximately 11 percent) increase in overall rail volume. If anhydrous ammonia is used, then rail use could total up to 80 shipments per year, which would result in approximately one to two additional rail shipments (or up to four additional train pass-bys) in any given week – a 7-percent increase over baseline volumes. The project would not result in significant delays to motorists during train pass-bys at the nearby at-grade crossings. Additionally, material handling from rail deliveries and railcar switching would occur within AEP property and, therefore, along with the low increase in rail usage, impacts to users of the same rail line would be minor.

Table 3.11 4. Traffic Volumes and LOS for 2016 No-Build and Build Conditions

Study Location on State Route 62	2016 No-Build			2016 Build				
	No-Build ADT[a]	One-Way Peak Hour Volume[b]	V/C[c, d] and LOS	Percent of New Car Trips Passing through Location[e]	Percent of New Truck Trips Passing through Location[f]	Build ADT[g] and [percent increase]	One-Way Peak Hour Volume[h] and [percent increase]	V/C[c, d] and LOS
T-1	6,164	555	0.37 C	45	50	6,213 [1]	577 [4]	0.39 C
T-2	4,623	416	0.28 C	60	50	4,686 [1]	445 [7]	0.30 C
T-3	2,260	203	0.14 B	70	50	2,333 [3]	237 [17]	0.16 B
T-4	1,901	171	0.11 A	70	50	1,973 [4]	205 [20]	0.14 B
T-5	1,284	116	0.08 A	65	50	1,348 [5]	145 [25]	0.10 A
T-6	1,798	162	0.11 A	60	50	1,847 [3]	184 [14]	0.12 A
T-7	1,233	111	0.07 A	60	50	1,277 [4]	131 [18]	0.09 A

[a] Assumed traffic rate increase was 0.3 percent per year.
[b] One-way peak hour volume for 2016 No-Build = directional distribution (60 percent) x peak hour volume (15 percent of ADT).
[c] V/C = volume-to-capacity, where V = one-way peak hour volume and C = lane capacity (1,700 vehicles per hour) x peak hour factor (0.88 for rural roads); ADT = average daily traffic; LOS = level of service.
[d] See Table 3.11-1 for descriptions of level of service designations.
[e] These values are based on the geographic distribution of commuter routes and represent the percent of the number of new car trips that could pass through the location.
[f] These values represent the percent of the number of new truck trips that could pass through the location. Because the truck routes are unknown at this time, it was assumed that 50 percent of the truck trips would pass through each study location (assumed that half of the trucks would travel in either direction on State Route 62).
[g] 2016 Build ADT = (2016 No-Build ADT) + (percent of new car trips passing through location x 94 car trips/day) + (percent of new truck trips passing through location x 14 truck trips/day).
[h] 2016 Build One-Way Peak Hour Volume = [2016 No-Build One-Way Peak Hour Volume] + [(94 car trips/day) / (2 peak hours/day) x (percent of new car trips passing through location)] + [(14 truck trips/day) / (8 hours/day) x (percent of new truck trips passing through location)].

3.11.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no impacts to transportation resources under the No Action Alternative. Roadways within the ROI would continue to operate at acceptable level.

3.12 NOISE

3.12.1 Introduction

This section identifies and describes local receptors potentially affected by the noise associated with the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects from this project on these receptors.

3.12.1.1 Region of Influence

The ROI for noise impacts was based on the estimated magnitude of noise generated by the project and baseline noise levels, which would affect how far away the noise might be heard. Therefore, the ROI includes the area within 1 mile of the CO_2 capture facility; within 1,000 feet of the pipeline corridors; within 3,000 feet of the injection well sites; and within 500 feet of main transportation routes. For proposed stationary (fixed-location) noise sources, the ROI is dependent on the magnitude of noise emissions that would be generated by new noise sources at each of these locations. Each location is, therefore, discussed in a separate subsection. For mobile (moving) noise sources, the ROI includes sensitive noise receptors located along main transportation routes that would be used in support of the project, which mainly includes State Route 62 and the CSX Transportation rail line.

3.12.1.2 Method of Analysis

DOE analyzed noise levels generated by stationary and mobile sources for potential impacts to sensitive noise receptors. The stationary sources analyzed below consisted of construction-related and CO_2 capture facility equipment. The mobile sources consisted of privately-owned vehicles (cars), trucks, and rail-cars transporting materials and by-products during the construction and operational phases. Noise levels were calculated based on widely-accepted noise principles and references, as described in the following section. Noise impacts were determined in relation to sensitive noise receptors, which include residences, schools, and hospitals. For impacts from stationary sources, DOE reviewed aerial photographs and maps of the proposed locations for the CO_2 capture facility, pipeline corridors, and injection well sites to identify the locations of sensitive receptors that may be affected by the project. As such, receptor counts presented in this section represent approximate values.

Noise Principles

Noise is defined as any unwanted sound. The human ear experiences sound as a result of pressure variations or vibrations in the air. Sound pressure is the physical force from a sound wave that affects the human ear, and is typically discussed in terms of decibels (dB), which is a logarithmic unit of the sound pressure level (SPL). To account for variations in the way humans perceive noise, a weighted scaling system is often used (referred to as the A-weighted scale and expressed as dBA). Typical noise levels for a variety of indoor and outdoor settings expressed on the A-weighted scale are presented in Figure 3.12-1, which also includes typical human perceptions for these noises.

The SPL that humans experience typically varies from moment to moment. Therefore, a variety of descriptors are used to evaluate noise levels over time. Typical descriptors used in this section are defined as follows:

- **L_{eq} (continuous equivalent sound level)** – a single value used to represent the sound level for a specific time period that is equivalent to the actual, varying sound level over the same period (i.e., the average sound level over a specific time period). High noise levels during a monitoring period would have greater effect on the L_{eq} than low noise levels.
- **L_{dn} (day-night average sound level)** – equivalent to a 24-hour L_{eq}, but with a 10-dBA penalty added to nighttime noise levels (10:00 p.m. and 7:00 a.m.) to reflect the greater intrusiveness of noise experienced during this time.

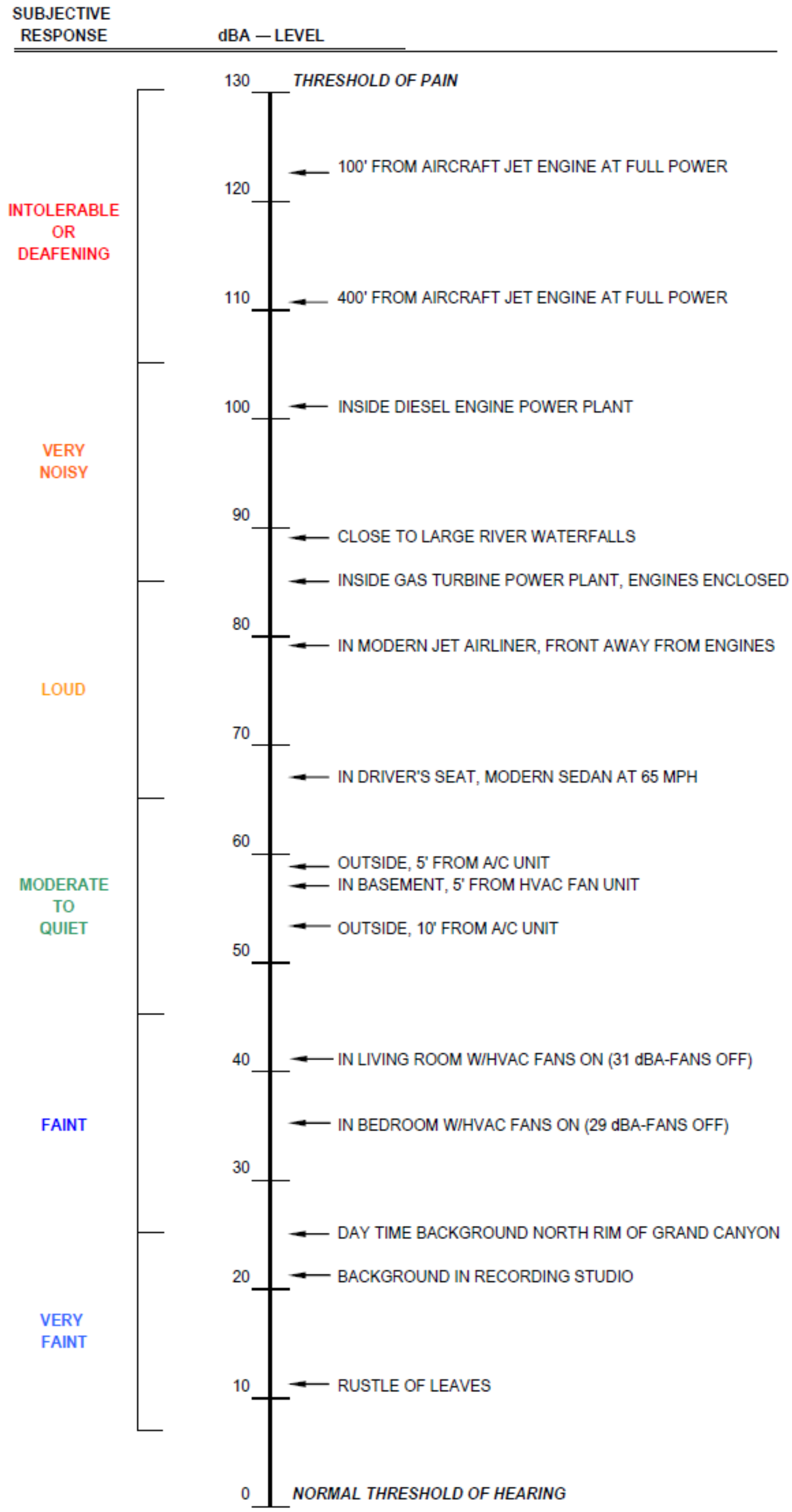

Figure 3.12-1. Decibel Levels for Common Sounds and Subjective Response
Source: Hessler Associates, 2008

- **L_{90} (sound level that is exceeded 90 percent of the time)** – the L_{90} percentile level is a common metric for evaluating community noise in residential environments and is a measure of the nominal background level. Typical L_{90} daytime levels found throughout the U.S. under calm and still wind conditions are shown in Table 3.12-1.

Table 3.12-1. Typical L_{90} Sound Levels in Residential Communities

Description	Typical Range, dBA	Average, dBA
Very Quiet Rural or Remote Area	26 to 30	28
Very Quiet Suburban or Rural Area	31 to 35	33
Quiet Suburban Residential	36 to 40	38
Normal Suburban Residential	41 to 45	43
Urban Residential	46 to 50	48
Noisy Urban Residential	51 to 55	53
Very Noisy Urban Residential	56 to 60	58

Source: EPA, 1971
dBA = A –weighted decibel; L_{90} = sound level that is exceeded 90 percent of the time

Because the decibel scale is logarithmic, sound levels cannot be added by ordinary arithmetic means. A relative increase of 10 dB represents an SPL that is 10 times higher. However, humans do not perceive a 10-dBA increase as 10 times louder; they perceive it as twice as loud. The human response to sounds measured in dBA has the following characteristics:

- A 3-dBA change is the threshold of change detectable by the human ear and is considered a barely discernable difference in ambient environments.
- A 5-dBA change is clearly noticeable and would typically result in a noticeable community response.
- A 10-dBA change is perceived as an approximate doubling of the noise level (almost always causes an adverse community response) or halving of the noise level.

Due to the logarithmic scale of the decibel, Table 3.12-2 identifies approximate additive properties used when adding noise levels from numerous sources.

Table 3.12-2. Approximate Addition of Sound Levels

Difference Between Two Sound Levels	Add to the Higher of the Two Sound Levels
1 dBA or less	3 dBA
2 to 3 dBA	2 dBA
4 to 9 dBA	1 dBA
10 dBA or more	0 dBA

dBA = A-weighted decibel

Noise from a given source attenuates (diminishes) with distance. The decrease in sound level from any single noise source normally follows the “inverse square law.” That is, the SPL change is inversely proportional to the square distance from the sound source. This means that the sound level would drop 6 dB each time the distance from the sound source is doubled. The amount of attenuation also depends on numerous factors, such as temperature and the amount of surrounding vegetation.

The level of highway traffic noise depends on traffic volumes, traffic speed, and the number of trucks in the traffic flow. Generally, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater numbers of trucks. In addition, there are other, more complicated factors that affect the loudness of traffic noise. For example, as a person moves away from a highway, traffic noise levels are reduced by distance, terrain, vegetation, and natural and manmade obstacles. Traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads (FHWA, 1995).

Stationary Noise Sources

DOE estimated potential stationary source noise levels during construction and normal plant operations at sensitive noise receptor locations by summing anticipated equipment noise contributions or identifying sound levels from dominant noise-producing equipment and applying fundamental noise attenuation principles. The following logarithmic equation was used to predict noise levels at various distances:

$$SPL_1 = SPL_2 - 20\text{Log}(D_1/D_2) - A\text{, where:}$$

- SPL_1 is the noise level at a given distance (D_1) due to equipment operating throughout the day;
- SPL_2 is the equipment noise level at a reference distance (D_2);
- D_1 is the distance from the equipment noise source;
- D_2 is the reference distance at which the equipment noise level is known; and
- "A" equals 8 for sound sources that were not considered elevated, to account for sound pressure propagating in a hemispherical manner (Lamancusa, 2009) (in other cases where sound sources may be elevated, "A" was given a 0 value).

DOE did not consider the effects of meteorology, terrain, structures, or vegetation, which can affect sound propagation (i.e., reduce sound levels) as these would be highly variable for each receptor location. Therefore, the results presented may be conservatively higher predictions of noise impacts. For construction of the injection wells, this would be especially true during the summertime as the majority of the injection well sites are located in heavily wooded areas where vegetation would substantially muffle sound levels.

There are no known applicable noise standards for the States of West Virginia or Ohio. Neither Mason County (West Virginia), Meigs County (Ohio), nor New Haven has a local ordinance that addresses noise from new development or construction activities. Therefore, benchmark noise criteria provided by the EPA and the U.S. Department of Housing and Urban Development (HUD) were used to evaluate potential impacts to sensitive noise receptors. The EPA determined that, in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed a day-night sound level (L_{dn}) of 55 dBA (EPA, 1974). This level is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. The HUD also established guidelines for evaluating noise impacts on residential areas and categorized noise levels for proposed residential development as *acceptable*, *normally unacceptable*, and *unacceptable*, as shown in Table 3.12-3 (HUD, 1985).

Table 3.12-3. U.S. Department of Housing and Urban Development Guidelines for Evaluating Sound Level Impacts on Residential Properties

Acceptability for Residential Use	Outdoor Guideline Levels (L_{dn})
Acceptable	$\leq$ 65 dBA (equivalent to 58.6 dBA L_{eq})
Normally Unacceptable	>65 dBA to $\leq$ 75 dBA
Unacceptable	> 75 dBA

Source: HUD, 1985
dBA = A-weighted decibel; L_{eq} = continuous equivalent sound level; L_{dn} = day-night average sound level

Mobile Noise Sources

DOE used proportional modeling to determine potential noise impacts from increased traffic during the construction and operational phases of the project. Using this technique, DOE based the prediction of the change in noise level on a calculation using predicted changes in traffic volumes to determine No-Build (without the project) and Build (with the project) traffic levels. For assumptions used to determine new traffic volumes, see Section 3.11, Traffic and Transportation. The years 2014 and 2016 were the future years analyzed as these years capture the peak construction period (for conservatism) and first full operational year of the CO_2 capture facility, respectively. Existing traffic data was obtained from the WVDOT. Future traffic conditions were projected using assumptions based on proposed and anticipated future traffic levels. Vehicular traffic volumes were converted into passenger car equivalent (PCE) values, for which 1 heavy truck was assumed to generate, on average, the noise equivalent of 47 cars. Future noise level changes on the key roadway segments studied were calculated using the following equation (Wu, 2005):

Predicted Change in Noise Level (dBA) = 10Log (Future Build PCE/Future No-Build PCE), where:

- future No-Build traffic volumes (i.e., without project-related vehicles) were calculated for 2014 and 2016;
- future Build traffic volumes for 2014 (peak construction) and 2016 (operation) were calculated by adding project-related vehicles to future No-Build volumes; and
- PCE – Passenger Car Equivalents (1 heavy truck = 47 PCEs).

In applying this equation, a doubling of PCEs would result in a 3-dBA increase in noise level (10 Log [2/1] = 3 dBA). A 10-fold increase in PCEs would result in a 10-dBA change (10 Log [10/1] = 10 dBA). For this analysis, a predicted 3-dBA increase (i.e., a doubling of PCEs) in the ambient noise level was the benchmark noise criterion for analyzing noise impacts to sensitive receptors located along primary project-related transportation routes. For the purposes of the traffic noise analysis presented in this EIS, motor vehicles were categorized as either cars (vehicles with two axles and four wheels) or trucks (vehicles with two or more axles and six or more wheels).

3.12.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to sensitive receptors based on whether the Mountaineer CCS II Project would directly or indirectly

- conflict with any local noise ordinances;
- cause perceptible increases in ambient noise levels at sensitive receptors during construction of the proposed CO_2 capture facility, pipeline corridors, and injection wells - either from mobile or stationary sources;
- cause perceptible increases in ambient noise levels at sensitive receptors during operation of the proposed CO_2 capture facility, pipeline corridors, and injection wells - either from mobile or stationary sources; or
- cause long-term increases in ambient noise levels at sensitive receptors - either from mobile or stationary sources.

3.12.2 Affected Environment

3.12.2.1 CO_2 Capture Facility

Existing dominant noise sources in the vicinity of the CO_2 capture facility mainly consist of traffic on State Route 62, operations at the existing Mountaineer Plant, rail traffic on the CSX Transportation rail line, and material handling equipment associated with the barge deliveries on the Ohio River. An environmental noise study conducted at the Mountaineer Plant in 2008, for purposes other than for this project was reviewed to ascertain the baseline noise conditions in the surrounding areas (Hessler Associates, 2008). For the 2008 noise study, sound levels were measured on a continuous and simultaneous basis over a 12-day period at five locations chosen to represent potentially sensitive noise receptors near the existing plant. These monitoring locations are shown in Figure 3.12-2. Descriptions of the locations and the sound monitoring results are provided below.

Receptor 1 includes privately-owned properties located approximately 2,600 feet from the proposed location of the CO_2 capture facility. Twelve homes are near State Route 62 in this area. The CSX Transportation rail line is also adjacent to the homes at the Receptor 1 location. Receptors 2 and 3 consist of dense residential development approximately 4,000 and 4,300 feet northwest of the proposed location of the CO_2 capture facility, respectively. This development is shielded from traffic on State Route 62 by housing structures and partially shielded from plant noise by a manmade earth berm. Receptors 4 and 5 include privately-owned properties near the project area, but across the Ohio River, on the shoreline. Continuous residential dwellings are located along both sides of Route 124 north of Receptor 4, which is approximately 3,900 feet north of the plant. Receptor 5 is located approximately 2,700 feet directly east of the Mountaineer Plant; these are homes close to the Ohio River, but it was not determined if these were seasonal or permanent dwellings.

Figure 3.12-2. Noise Monitoring Locations near the CO_2 Capture Facility

The 2008 noise study used L_{90} and L_{dn} values to evaluate noise levels at the receptor locations. Table 3.12-4 summarizes the ambient noise monitoring results. Receptor 1 experienced daytime L_{90} values between 48 and 52 dBA, which corresponds to a more urban environment (see Table 3.12-1); the average L_{dn} at Receptor 1 was estimated to be 68.9 dBA. Contributing noise sources in this area include traffic on State Route 62, railcars on the CSX Transportation rail line, and plant noise. The lowest L_{90} values (30 dBA) occurred in the dense residential development located northwest of the plant, Receptors 2 and 3. The daytime L_{90} values at Receptors 2 and 3 were in the range of 40 to 45 dBA, which correspond to a normal suburban residential neighborhood; the average L_{dn} at Receptors 2 and 3 were estimated to be 54.1 and 55.0 dBA, respectively. Depending on weather conditions (e.g., direction of wind), noise associated with the plant's coal conveyor system, as well as a very low-level "hum" from the induced draft fan system, could be detected at Receptors 1, 2, and 3. Plant noise was observed to be the dominant source of environmental noise at Receptors 4 and 5, though traffic on Route 124 also contributed to noise levels. Daytime L_{90} values for Receptor 4 were between 45 and 50 dBA – which correspond to an urban area – and the average L_{dn} was 61.9 dBA. At Receptor 5, L_{90} values never fell below 50 dBA – daytime L_{90} values ranged between 50 and 55 dBA, which corresponds to a noisy urban environment; the average L_{dn} at Receptor 5 was 63.6 dBA.

Table 3.12-4. Ambient Noise Levels at Sensitive Noise Receptors near the CO_2 Capture Facility

Sensitive Noise Receptor[a]	Approximate Distance from Existing Plant (feet)	Daytime L_{90}, Average Range[b] (dBA)	Average Day-Night Sound Level[b] (L_{dn}) (dBA)
Receptor 1	2,600	48 – 52	68.9
Receptor 2	4,000	40 – 45	54.1
Receptor 3	4,300	40 – 45	55.0
Receptor 4	3,900	45 – 50	61.9
Receptor 5	2,700	50 – 55	63.6

[a] Refer to Figure 3.12-2 for a map of these locations.
[b] Hessler, 2008.
dBA = A-weighted decibel; CO_2 = carbon dioxide; L_{dn} = day-night average sound level; L_{90} = sound level that is exceeded 90 percent of the time

Note that all average L_{dn} values in the study were estimated to either exceed or are near the EPA threshold of 55 dBA for activity interference and annoyance outdoors in residential areas, but the measured daytime L_{dn} and L_{90} values do not exceed the HUD thresholds of 65 dBA and 58.6 dBA, respectively, for acceptability of outdoor noise levels – except for Receptor 1, which exceeds HUD's L_{dn} criteria of 65 dBA.

3.12.2.2 Pipeline Corridors

Noise sources along the potential pipeline corridors primarily consist of vehicular traffic as the area is located near roadways within a predominately rural area. Ambient noise data along the pipeline corridors are not available. The corridors traverse mostly undeveloped, rural lands and are located near roadways that experience relatively low daily traffic volumes. Therefore, it is assumed that baseline noise levels would be around 35 dBA, which is a typical sound level for rural areas (see Table 3.12-1). The number of sensitive noise receptors within 1,000 feet of the pipeline corridors varies from 0 to approximately 42 and is identified for each pipeline route in Table 3.12-7.

3.12.2.3 Injection Well Sites

Noise sources in the vicinity of the potential injection well sites primarily consist of vehicles on nearby roadways as the sites are fairly isolated and surrounding areas are predominately rural. Ambient noise data at the injection well sites are not available. The injection well sites are located in mostly undeveloped, isolated wooded areas; therefore, it is assumed that baseline noise levels would be in the range of 25 to 35 dBA (see Table 3.12-1). The number of sensitive noise receptors within 3,000 feet of the injection well sites varies from 0 to approximately 64 and are identified for each potential site in Table 3.12-8.

3.12.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to sensitive receptors in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.12.1.3.

3.12.3.1 Construction Impacts

3.12.3.1.1 Stationary Noise Sources

Ambient noise levels within the vicinity of the construction sites for the CO_2 capture facility, pipeline corridors, and injection well sites would increase as a result of construction-related activities and equipment. To determine the extent of noise impacts from stationary noise sources during construction, noise level increases were estimated using the approach discussed in Section 3.12.1.2. New noise levels were projected from anticipated construction equipment that would be considered dominant noise sources. The approximate number of sensitive noise receptors that may be impacted was estimated using aerial mapping sources.

CO_2 Capture Facility

Noise levels generated during construction at the CO_2 capture facility would vary, depending on the phase of construction. Typical construction activities would be expected to consist of the following phases:

- Site preparation and excavation
- Foundation and concrete pouring
- Erection of building components
- Finishing and cleanup

It is expected that construction noise contributions would be greatest at the CO_2 capture facility construction site during the initial site preparation and excavation phase. This is due to the almost constant engine and earth-breaking noises associated with the use of heavy equipment, such as a backhoe excavator, earth grader, compressor, and dump truck. Table 3.12-5 presents average noise levels from construction equipment typically used at industrial construction sites.

Table 3.12-5. Common Equipment Sources and Measured Noise Levels at a 50-Foot Reference Distance

Equipment	Typical Noise Level in dBA
Backhoe Excavator	85
Bulldozer	80
Grader	85
Dump Truck	91
Pump	76
Compressor	81

Source: Bolt et al., 1971
dBA = A-weighted decibel

Based on the noise levels listed in Table 3.12-5 and by applying the approximate addition of sound levels as described in Table 3.12-2, the overall sound level at the CO_2 capture facility site is estimated to be approximately 93 dBA. To predict the noise impact on the sensitive receptors identified in Figure 3.12-2, the 93-dBA noise level was conservatively estimated (assuming all equipment are operational concurrently at the same location) from the construction site to various distances by applying general noise attenuation principles. The noise projections for each of the receptor locations identified in Figure 3.12-2 are presented in Table 3.12-6.

Table 3.12-6. Estimated Noise Levels during Construction of the CO_2 Capture Facility

Noise Receptor[a]	Distance from the CO_2 Capture Facility (feet)	Equipment Sound Level at Source[b] (dBA)	Equipment Sound Level at Distance of Receptor[c] (dBA)	Existing Sound Level at Receptor[d] (dBA)	New (Predicted) Sound Level at Receptor[e] (dBA)	Change in Sound Level at Receptor (dBA)
Receptor 1	2,600	93	58.7	48	59.0	11.0
Receptor 2	4,000	93	54.9	40	55.1	15.1
Receptor 3	4,300	93	54.3	40	54.5	14.5
Receptor 4	3,900	93	55.2	45	55.6	10.6
Receptor 5	2,700	93	58.4	50	58.9	8.9

[a] See Figure 3.12-2 for a map of the locations.
[b] Based on the combined sound level of equipment listed in Table 3.12-5.
[c] Based on the equation identified in Section 3.12.1.2 (under Stationary Noise Sources).
[d] Values shown may be conservative as these represent the lower end of the range of L_{90} measurements recorded in the 2008 noise study (Hessler, 2008).
[e] New sound levels represent the combined values of "Equipment Sound Level at Distance of Receptor" and "Existing Sound Level at Receptor."
dBA = A-weighted decibel; CO_2 = carbon dioxide

As Table 3.12-6 shows, construction of the CO_2 capture facility could be audible at all receptor locations as the projected increase in noise levels would be in the range of 8.9 to 15.1 dBA. The actual degree of change may be less than the values shown because meteorological conditions, vegetation, and topography were not accounted for in the estimates. Additionally, the results assume all equipment would be running concurrently. At Receptors 2 and 3, it is likely that the increase in sound levels would be less than predicted as the manmade berm would attenuate construction noise. Construction noise would likely be masked by traffic on State Route 62 for privately-owned properties at Receptor 1. In general, Location 5 would experience the highest noise impacts from construction as this location is directly east of the project site and there are no substantial buffers that would decrease construction sound emissions.

Noise impacts to nearby receptors are expected to range from minor to moderate as the predicted noise levels would be over the EPA threshold (L_{eq} of 48.6 dBA), but within or near levels classified by HUD as "acceptable" for outdoor levels at residential properties (L_{eq} of 58.6 dBA). Furthermore, audible increases in noise levels would be temporary, occurring mainly during site preparation activities (i.e., expected to take approximately 1 to 2 months).

For the most part, construction would occur during a normal 5-day work week, within a 10-hour day; however, depending on construction progress, it is possible that work may be done on Saturdays and/or double-shifts, though, it is anticipated that such cases would be limited to the extent practicable. A short-term, overall moderate noise impact is anticipated to sensitive noise receptors near the Mountaineer Plant during construction of the CO_2 capture facility. To further reduce noise levels, AEP would limit the noisiest construction activities (e.g., pile driving activities, if required) to daytime hours to the extent practical.

Pipeline Corridors

Construction of the potential pipeline corridors would consist of site clearing, excavation, trenching, pipe laying, and finishing work. These activities would require the use of heavy-duty construction equipment (e.g., trenching equipment, trucks, graders, backhoes, excavators, and portable generators). Use of this equipment would likely result in temporary increases in ambient noise levels in the immediate area of the potential construction site. The sound levels resulting from linear facility construction activities would vary greatly depending on such factors as the types of activities being performed and equipment being used.

Average noise levels from typical pipeline construction equipment would be similar to those listed in Table 3.12-5. DOE estimates that an overall noise level, excluding the use of horizontal directional drilling equipment, would be approximately 92 dBA at 50 feet. This calculation conservatively assumes that all equipment would be operating simultaneously. At 500 and 1,000 feet from the construction site, noise levels would be around 64 and 58 dBA, respectively. Horizontal directional drilling equipment may be required to construct pipelines under water features, roadways, and other obstacles. Such equipment could result in sound levels around 67 and 61 dBA at 500 and 1,000 feet, respectively. Table 3.12-7 lists the number of receptors within 500 and 1,000 feet of each potential pipeline route and the distance to the nearest receptor.

Noise generated by construction activities of the pipeline would mostly be screened by trees and vegetation and/or masked by noise from other manmade activities, such as traffic on adjacent roadways. Therefore, actual noise levels may be lower than predicted. The Western Sporn Route would have the greatest number of sensitive noise receptors and shortest distances to nearby receptors. Due to the intermittent and linear nature of the pipeline construction, minor to moderate impacts to nearby receptors are expected, depending on the proximity to the construction site. The majority of the construction is expected to occur during a normal 5-day work week, within a 10-hour day; however, depending on how construction progresses, it is possible that work may be done at other times and would be limited to the extent practicable. Additionally, to further reduce noise levels, AEP would limit the noisiest construction activities (e.g., directional drilling, if required) to daytime hours, to the extent practical.

Table 3.12-7. Number of Sensitive Noise Receptors within 500 and 1,000 Feet of the Potential Pipeline Corridors

Potential Injection Well Property	Pipeline Route Options	No. of Receptors within 500 Feet[a,b]	No. of Receptors within 1,000 Feet[a,c]	Distance to Closest Receptor (feet)
Mountaineer Plant	Plant Routing	0	0	2,700
Borrow Area	Borrow Area Route	0	0	2,700
Eastern Sporn Tract	Eastern Sporn Route 1	1	2	403
	Eastern Sporn Route 2	2	12	346
	Eastern Sporn Route 3	1	5	403
	Eastern Sporn Route 4	3	16	208
Jordan Tract	Jordan Route 1	4	11	244
	Jordan Route 2	3	11	211
	Jordan Route 3	5	15	208
	Jordan Route 4	4	15	208
Western Sporn Tract	Western Sporn Route	19	42	38

[a] Counts are based on a review of aerial images and, therefore, should be considered approximate estimates.

[b] The predicted dBA levels without and with horizontal directional drilling are 64 and 67 dBA, respectively, for receptors located 500 feet from construction site.

[c] The predicted dBA levels without and with horizontal directional drilling are 58 and 61 dBA, respectively, for receptors located 1,000 feet from construction site.

Blasting would be required where consolidated rock cannot be trenched or ripped. Locations where blasting may be needed are unknown at this time; however, to the extent practicable, design of the pipeline would minimize the need for blasting. Blasting would produce noise levels greater than 90 dBA at the source and would depend on the size of the blast. In addition to intermittent, acute noise increases, blasting can also result in offsite damage due to ground vibration. The primary factors that most influence the magnitude of impacts from ground vibration are the weight of explosives and the distance from the blast to the point of concern.

To ensure that blasting impacts are minimal, AEP would develop a blasting plan for safety purposes and would notify occupants of nearby buildings, residences, agricultural areas, and other areas of public gathering sufficiently in advance. Blasting would occur on an intermittent basis over a relatively short period of time. Any potential blasting is expected to result in minor to moderate impacts, depending on the distance to the closest sensitive noise receptor(s).

Injection Well Sites

Primary sources of noise during construction of the potential injection well sites would be from site preparation equipment and a drill rig with supporting equipment (e.g., compressors, boosters, pumps, and diesel engines). Greater levels of noise would be restricted to the immediate vicinity of the injection well site. Because the drilling would occur over a continuous, 24-hour duration (and 7 days a week, over approximately 8 to 12 weeks) and would be the dominant noise source, sound levels from the drilling equipment (98 dBA at 50 feet) were used to estimate potential noise impacts to receptors. Based on general attenuation principles described in Section 3.12.1.2, DOE predicted noise levels at various distances. These modeling data are provided in Table 3.12-8. Table 3.12-8 also identifies the approximate number of sensitive noise receptors within various distances from each injection well site.

Table 3.12-8. Estimated Sound Levels during Construction of Potential Injection Well Sites and Number of Noise Receptors within Various Distances

Distance (feet)	Projected Sound Level[a] (dBA)	Mountaineer Plant[b] (MT-1)	Borrow Area[b] (BA-1)	Eastern Sporn Tract[b,c] (Between ES-1 and ES-3)	Jordan Tract[b,c] (JT-1)	Western Sporn Tract[b,c] (WS-1)
500	70.0	0	0	***2***	***0***	***0***
1,000	64.0	0	0	***4***	***0***	***11***
2,000	58.0	0	0	***6***	***3***	***28***
3,000	54.4	30	0	16	21	64
Distance to Nearest Receptor (feet)		2,700	3,830	380	1,210	580

[a] Based on average sound levels from a rock drill, 98 dBA at 50 feet (source: Bolt et al., 1971) and the equation identified in Section 3.12.1.2 (under Stationary Noise Sources).

[b] Identification of potential sensitive noise receptors is based on review of aerial photographs and, therefore, estimates shown are approximate.

[c] Counts shown in bold italic text indicate number of receptors that could experience substantial noise impacts (without noise mitigation measures).

Except for the Injection Well Site MT-1 at Mountaineer Plant, no ambient noise measurements are available in areas surrounding the injection well sites. If ambient noise levels are around 35 dBA, as are typical of rural areas, sensitive noise receptors could experience audible increases in sound levels of up to 35 dBA (for those within 500 feet), depending upon the distance and season of construction. Vegetation was not accounted for in estimating noise levels; therefore, the calculated sound levels are considered conservative as the majority of the potential injection well sites are located in wooded areas. In addition, privately-owned properties in the area are typically surrounded by heavy vegetation that can substantially attenuate sound levels. Projected sound levels would be within the EPA threshold (L_{eq} of 48.6 dBA) at receptors located beyond a 1-mile distance and within the HUD threshold (L_{eq} of 58.6 dBA) at receptors located beyond 2,000 feet. However, as shown in Table 3.12-8, approximately 54 receptors (within 2,000 feet) could experience substantial, short-term noise impacts during construction of the injection well sites. The majority of these would be near the Western Sporn Tract.

Depending on scheduling and cost factors, it is possible that more than one well would be constructed simultaneously at an injection well site. If this were to occur, the projected sound levels would not double, but would increase by approximately 3 dBA, following general rules used to add numerous noise sources as discussed in Section 3.12.1.2. At the CO_2 capture facility construction site, substantial noise increases, without mitigation, could result (as Table 3.12-6 indicates) in audible noise level increases at all receptor locations, and projected noise levels at Receptors 1 and 5 could exceed or would be near the HUD acceptability threshold for outdoor noise levels (L_{eq} of 58.6 dBA).

AEP would take noise measurements prior to construction and during initial drilling of the injection wells to determine the change in ambient sound levels at the closest sensitive noise receptor. Where substantial noise increases occur, AEP would use acoustic shields on equipment and implement other appropriate noise mitigation measures to reduce noise levels. Therefore, minor to moderate (short-term) noise impacts are expected, depending on the number of receptors near the injection well site and final sound levels as reduced by AEP's mitigation measures.

DOE anticipates that AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of the geologic characterization study. AEP anticipates the need for one to three monitoring wells per injection well site, or per co-located pair of injection wells. Related noise impacts would be similar to those described for the construction of the injection wells.

3.12.3.1.2 Mobile Noise Sources (All Proposed Project Components)

Ambient noise levels along the primary construction traffic routes would likely increase as a result of construction-related vehicles entering or leaving a particular construction site. The change in noise level was estimated for the peak hour, as the majority of project-related vehicles (i.e., from construction workers commuting to/from construction sites) would occur during this time period. To determine the extent of traffic noise impacts, noise level increases were estimated using the approach discussed in Section 3.12.1.2 for mobile noise sources. This estimation was based on comparing existing and future (2014) traffic volumes. Because the majority of vehicles would mainly access the various construction sites (i.e., at the CO_2 capture facility, pipeline corridors, and injection well sites) from State Route 62, noise impacts were evaluated for key segments on this highway, as shown in Figure 3.11-2 (Section 3.11, Traffic and Transportation). For a discussion of assumptions used to determine project-related traffic volumes, see Section 3.11, Traffic and Transportation.

The analysis of maximum potential traffic noise impacts assumed that construction of the CO_2 capture facility, one pipeline segment, and eight injection well sites would be constructed simultaneously. Therefore, a combined daily traffic volume would consist of up to 1,660 car trips and 88 truck trips. Table 3.12-9 presents the predicted noise level increases on segments of State Route 62 (see Figure 3.11-2 for traffic locations).

The greatest noise impacts from mobile sources would occur during the peak morning and afternoon commute hours. These impacts would mainly be limited to State Route 62, near the CO_2 capture facility because the construction of this facility would generate the greatest amount of new traffic. As the results indicate, increases in traffic would not generate discernable increases in noise levels for any of the locations under all scenarios (i.e., all predicted noise increases would be less than 3 dBA).

Table 3.12-9. Estimated Noise Level Increase from Construction-Related Vehicles during Peak Construction Conditions (2014)

Study Location on State Route 62[a]	2007 ADT[b]	2014 No-Build 2014 ADT[c]	2014 No-Build Two-Way Peak Hour[d]	2014 Build Two-Way Peak Hour[e]	Predicted Noise Level Increase[f]
T-1	6,000	6,127	919	1,301	0.4
T-2	4,500	4,595	689	1,196	0.6
T-3	2,200	2,247	337	926	1.2
T-4	1,850	1,889	283	873	1.4
T-5	1,250	1,276	191	698	1.8
T-6	1,750	1,787	268	650	1.2
T-7	1,200	1,225	184	524	1.5

[a] See Figure 3.11-2 (Section 3.11, Traffic and Transportation) for the map of traffic-analysis locations.
[b] ADT – average daily traffic; source: WVDOT, 2007.
[c] Projected to 2014, assuming peak construction year; annual percent increase 0.3 percent (see also Section 3.11, Traffic and Transportation).
[d] Total two-way peak-hour volume (i.e., both directions) for 2014 No-Build assumed to be 15 percent of ADT (source: TRB, 2000).
[e] Added project-related car and truck volumes to 2014 No-Build two-way peak hour. See Section 3.11, Traffic and Transportation, for number of new daily car and truck trips.
[f] Converted traffic within two-way peak hour to PCEs (for 2014 No-Build, assumed trucks were 18 percent of two-way peak hour, where 1 truck = 47 PCEs). To estimate changes in noise levels, used equation: Predicted Change in Noise Level =10 x Log(Build two-way peak hour PCE / No-Build two-way peak hour PCE).

Potential construction traffic-related noise is expected to result in overall negligible impacts to baseline noise conditions in the ROI. This conclusion is based on the following reasons: the results indicate low noise level increases; projected noise level results are assumed to be conservative (i.e., assumes simultaneous construction of various project components and that all projected-related traffic would pass through each location analyzed); and impacts would be limited to the peak construction months in 2014. It should be noted that, although the traffic noise impacts for the smaller connector roads leading up to potential construction sites for the pipeline corridors and injection wells were not quantified, it is assumed that the majority of ADT volumes would result from construction workers, which would be relatively low (approximately 40 privately-owned vehicles per day per injection well site or pipeline segment). It is assumed that this would represent a minor impact in overall noise levels as the additional increase in traffic would be low and these roads traverse rural, isolated areas with relatively low numbers of sensitive noise receptors.

3.12.3.2 Operational Impacts

3.12.3.2.1 Stationary Noise Sources

CO_2 Capture Facility

The CO_2 compressor, booster fan, and refrigerant chillers would generate the greatest noise levels at the CO_2 capture facility; however, no sound level data is available for any of this equipment as the specific models or vendors have not yet been selected. It is assumed that the CO_2 capture facility would not generate a sound level that exceeds the overall current level at the existing Mountaineer Plant (approximately 116 dBA). Therefore, a combined new noise level of 119 dBA from the CO_2 capture facility was projected to the receptors identified in Section 3.12.2.1 and Figure 3.12-2. The predicted sound levels at these receptor locations are presented in Table 3.12-10

Table 3.12-10. Estimated Sound Levels from the CO_2 Capture Facility

Sensitive Noise Receptor[a]	Distance (feet)	Equipment Sound Level[b] (dBA)	Attenuation of CO_2 Capture Facility[c] (dBA)	Existing Sound Level[d] (dBA)	New Sound Level[e] (dBA)	Change in Sound Level (dBA)
Receptor 1	2,600	119	50.7	48	52.6	4.6
Receptor 2	4,000	119	47.0	40	47.8	7.8
Receptor 3	4,300	119	46.3	40	47.2	7.2
Receptor 4	3,900	119	47.2	45	49.2	4.2
Receptor 5	2,700	119	50.4	50	53.2	3.2

[a] See Figure 3.12-2 for location map.
[b] Assuming CO_2 capture facility would not exceed existing plant noise (approximately 116 dBA) and, therefore, the maximum new noise level would result from doubling the existing sound level (i.e., an additional 3 dBA to 116 dBA).
[c] Based on the equation identified in Section 3.12.1.2 (under *Stationary Noise Sources*).
[d] Values shown may be conservative as these represent the lower end of the range of L_{90} measurements recorded in the 2008 noise study (Hessler, 2008).
[e] New sound levels represent the combined values of "Attenuation of CO_2 Capture Facility" and "Existing Sound Level."
dBA = A-weighted decibel; CO_2 = carbon dioxide

As the results shown in Table 3.12-10 indicate, the CO_2 capture facility may be audible at all receptor locations. The projected increase in noise levels could be in the range of 3 to 8 dBA. The actual degree of change may be less than the values shown as meteorological conditions, vegetation, and topography were not accounted for in the estimates. Predicted noise levels would be near or over the EPA threshold (L_{eq} of 48.6 dBA) at Receptors 1, 4, and 5 (note, however, that the existing sound level at Receptors 1 and 5 are already over or near this threshold), but within levels classified by HUD as "acceptable" for outdoor levels at residential properties (L_{eq} of 58.6 dBA) at all locations. Noise increases from equipment handling material from barge shipments may occur, but these would be localized, intermittent, and not expected to exceed detectable levels to nearby receptors (i.e., changes in noise levels are expected to be less than 5 dBA to nearest receptor). It is not expected that clearly discernable increases in sound levels would occur at any of the sound levels (i.e., greater than 5 dBA increase). The berm located near Receptors 2 and 3 would likely reduce the change in sound levels to less than a 5-dBA increase.

Final design and selection of equipment would take into account AEP's mechanical equipment and component design criteria for noise. Upon final design and selection of equipment, AEP would acquire noise evaluations and incorporate sound enclosures, barriers, and/or sound dampening materials, as appropriate, to meet these criteria. The design would also consider equipment in groups and/or in common areas and incorporate noise abatement, as practical, to minimize the overall impact to the surrounding area. Potential noise mitigation measures that may be incorporated into the CO_2 capture facility include: locating and orienting plant equipment to minimize sound emissions; providing buffer zones; enclosing noise sources within buildings; and including silencers on vents and relief valves. Therefore, it is expected that sound levels from the CO_2 capture facility would be mitigated to near non-detectable sound level increases (i.e., the new facility would only produce a noise level change of 5 dBA or less) and would result in minor, long-term noise impacts to nearby receptors.

Pipeline Corridors

The potential pipeline would be buried except where the pipeline would cross a vertical rock outcropping and where it would be necessary to come to the surface for valves and metering. Potential noise impacts from pipeline aboveground equipment are anticipated to be negligible during operation.

Injection Well Sites

Operations at the potential injection well sites would consist of pumping CO_2 underground and maintaining the injection wells. Therefore, minimal noise impacts would occur during normal operations. During maintenance, certain activities such as acidizing, swabbing, and fracturing, could temporarily increase sound levels to those presented in Table 3.12-8 or less. If conducted, these activities would likely take place during initial drilling activities or annual workover activities. Additionally, the occasional transport of by-products generated during maintenance activities, as discussed in Section 3.12.3.2.2, would also contribute to temporary increases in noise. Due to the temporary nature of the activities, noise impacts are considered negligible to moderate, depending on the distance to the nearest receptors.

3.12.3.2.2 Mobile Noise Sources (All Proposed Action Components)

Ambient noise levels along primary operational traffic routes would likely increase as a result of trucks transporting waste and materials and employee cars commuting to/from the CO_2 capture facility. Occasional maintenance checks on the pipeline and wells would also add new vehicle trips, although these traffic volumes would be low and any potential impacts would be negligible.

To determine the maximum potential noise impact from traffic during operations, it was assumed that two wells would be constructed at four different sites as this would generate additional maintenance vehicles. Therefore, a combined daily traffic volume would consist of up to 122 car trips and 20 truck trips. Table 3.12-11 presents the predicted noise levels related to increased operational traffic volumes.

Table 3.12-11. Estimated Noise Level Increase from Operation-Related Vehicles (2016)

Study Location[a] on State Route 62	2007 ADT[b]	2016 No-Build ADT[c]	2016 No-Build Two-Way Peak Hour[d]	2016 Build Two-Way Peak Hour[e]	Predicted Noise Level Increase[f]
T-1	6,000	6,164	925	947	0.03
T-2	4,500	4,623	693	723	0.05
T-3	2,200	2,260	339	373	0.10
T-4	1,850	1,901	285	319	0.12
T-5	1,250	1,284	193	222	0.17
T-6	1,750	1,798	270	292	0.11
T-7	1,200	1,233	185	205	0.15

[a] See Figure 3.11-2 (Section 3.11, Traffic and Transportation) for the map of traffic-analysis locations.

[b] ADT – average daily traffic; source: WVDOT, 2007.

[c] Projected to 2016, assuming first full year of operation of the CO_2 storage facility; annual percent increase 0.3 percent (see also Section 3.11, Traffic and Transportation).

[d] Total two-way peak hour volume (i.e., both directions) for 2016 No-Build assumed to be 15 percent of ADT (source: TRB, 2000).

[e] Added project-related cars and truck volumes to 2016 No-Build two-way peak hour. See Section 3.11, Traffic and Transportation, for number of new daily car and truck trips.

[f] Converted traffic within two-way peak hour to PCEs (for 2016 No-Build, assumed trucks were 18 percent of two-way peak hour, where 1 truck = 47 PCEs). To estimate changes in noise levels, used equation: Predicted Change in Noise Level =10 x Log (Build two-way peak hour PCE / No-Build two-way peak hour PCE).

As the results shown in Table 3.12-11 indicate, increases in operation-related traffic would not generate any discernable increase in noise levels at any of the locations, under any of the scenarios. Therefore, new traffic volumes would be expected to result in negligible long-term impacts to overall baseline noise conditions in the project ROI.

Depending on the final decision on mode of transport for the reagent and sulfuric acid (see Section 3.11, Traffic and Transportation), annual deliveries of up to 137 railcar shipments per year are expected to result in a small increase to the existing rail traffic as this would result in adding approximately 6 train pass-bys per week, compared to the existing rail traffic of approximately 56 train pass-bys per week. The increases in noise levels resulting from rail transport of materials are not expected to differ from baseline rail noise levels, but would increase slightly in frequency. The occurrence of horn soundings at the at-grade crossing would increase by approximately two to four times a week; New Haven would experience this at the one public crossing on Midway Drive. Potential rail noise would result in minor noise impacts as the increase in rail traffic is expected to be low and the increases would be intermittent.

3.12.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to noise.

3.13 MATERIALS AND WASTE MANAGEMENT

3.13.1 Introduction

This section identifies and describes the existing materials used and stored at the Mountaineer Plant, in addition to the suppliers of materials, and waste management facilities in the region potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects from this project on the availability of materials and the capacity of waste management facilities to accommodate the project while continuing to meet the needs of other users.

3.13.1.1 Region of Influence

The ROI for materials and waste management includes waste management facilities, industries that could use by-products from the project, and the suppliers of construction materials and process chemicals used in the construction and operation of the project.

Construction and operation of the project would require construction materials (e.g., concrete, asphalt, and rock), construction equipment, process-related materials, access to markets for its by-products, and disposal of any waste generated. The extent of the ROI varies by material and waste type and is described as follows:

- The ROI for routine construction material suppliers and solid waste disposal facilities would be limited to the area within approximately 50 miles of the proposed site. These types of resources are widely available within this area and suppliers within the ROI would likely be used given that the volume of materials needed and the amount of waste generated are costly to transport over long distances.
- The ROI for treatment and disposal facilities needed for the types and quantities of hazardous wastes that may be generated includes a multi-state area within approximately 225 miles (the maximum distance to waste management facilities currently used by AEP) from the project.
- The ROI for the specialized CAP equipment is expected to extend to a national level. Similarly, the ROI for process chemicals is national, especially if the cost or value of the chemical makes it economical to transport over a greater distance. However, the ultimate distance to suppliers may include non-domestic sources to the extent that equipment or chemicals are not readily available domestically.
- The ROI for industries that may purchase the CAP by-product (i.e., ammonium sulfate) would most likely be within approximately 225 miles of the proposed site as this by-product can be used by local agricultural operations. However, the ultimate distance to potential purchasers would be driven by market demand.

3.13.1.2 Method of Analysis

DOE evaluated potential impacts by comparing the demands posed by construction and operation of the project to the capacities of materials suppliers, by-product purchasers, and waste management facilities within the ROI. In addition, DOE analyzed proposed operations and materials unloading and storage systems with respect to applicable federal, state and local regulations.

3.13.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to materials and waste management based on whether the project would directly or indirectly

- require materials that are not regionally available;
- cause new sources of construction materials and operational supplies to be built, such as new mining areas, processing plants, or fabrication plants;
- affect the capacity of existing material suppliers and industries in the region;
- create wastes for which there are no commercially available disposal or treatment technologies;
- create hazardous wastes in quantities that would require a treatment, storage, or disposal permit under the Resource Conservation and Recovery Act;
- affect the capacity of hazardous or solid waste collection services and landfills; or
- create reasonably foreseeable conditions that would increase the risk of a hazardous material or waste release.

3.13.2 Affected Environment

3.13.2.1 CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Construction Materials

Common construction materials such as ready-mix concrete, gravel fill, reinforcing steel, equipment rentals, piping and welding materials, well construction materials, heavy equipment, and office supplies are available from numerous in-state suppliers, with out-of-state suppliers available as necessary. AEP currently uses local and regional vendors for construction materials and has contracts in place with vendors to purchase these materials Process equipment such as absorbers, regenerators, pumps, heat exchangers, electrical switchgear, and refrigeration equipment would be purchased from domestic suppliers to the extent such equipment meets design specifications and is available.

Process Materials

At present, no materials are stored or used on properties proposed for pipeline corridors or injection well sites. This section, therefore, discusses the existing Mountaineer Plant only, including the process materials associated with its current operations and applicable plans in place at the plant for the safe handling and storage of materials.

The main raw material stored and used at the Mountaineer Plant is coal. The plant uses, on average, approximately 10,000 tons of coal per day. Coal is stored onsite in a 26-acre coal yard. Other materials used in large quantities at the plant are stored in aboveground storage tanks (ASTs) and include various types of fuels and process chemicals. Smaller quantities of materials are stored in 55-gallon drums or smaller containers. At the plant, there are 27 petroleum ASTs and 22 bulk chemical storage ASTs located outside of the main plant building in contained areas. The bulk chemical ASTs store sulfuric acid, urea solution, sodium hydroxide, polymer, diethylene glycol, and dust suppressant. Oil products, such as hydraulic oils, motor oils, and transformer oils, are delivered in 55-gallon drums and stored in a covered storage area equipped with containment. This covered storage area is located south of the main plant building. Two underground storage tanks are used as ignition oil drain tanks on the property.

The Mountaineer Plant stores more than 1,320 gallons of petroleum products and has a total petroleum product (i.e., oil) capacity of more than 1 million gallons. Therefore, in accordance with 40 CFR 112, the Mountaineer Plant has an SPCC Plan and an EPA Facility Response Plan in place to prevent the release of petroleum products into waters of the U.S. The Mountaineer Plant also has a Coast Guard Facility Response Plan in place as mandated by 33 CFR 154. In brief, this program requires all fixed marine transportation-related facilities that, because of their location, could reasonably be expected to cause at least substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines. The Mountaineer Plant SPCC Plan, EPA Facility Response Plan, and the Coast Guard Facility Response Plan are all incorporated into the plant's current Integrated Contingency Plan.

Non-Hazardous Solid Waste

The existing Mountaineer Plant uses an AEP-owned landfill (Little Broad Run Landfill) located onsite approximately 2 miles south of the plant for the disposal of the majority of its solid waste. The 325-acre Little Broad Run Landfill was constructed in 1980 to support AEP's Mountaineer Plant, Sporn Plant, and Mitchell Power Plant for coal combustion by-product disposal. Sludge, fly ash, bottom ash, and gypsum generated from the WWTP at the Mountaineer Plant are disposed of at this landfill (WVDEP, 2009d). Based on the Mountaineer Plant 2009 Annual Report, the Little Broad Run Landfill accepted gypsum (514,395 tons), WWTP sludge (8,239 tons), fly ash (368,668 tons), and bottom ash (17,176 tons). The landfill is divided into 11 disposal cells; one cell (cell number 6) is currently active. The Little Broad Run Landfill is permitted under the West Virginia Solid Waste Rules and NPDES Permit No. WV0077038. AEP projects the landfill's lifespan as lasting through 2038. Other Mountaineer Plant solid waste streams (i.e., primarily general office trash) are sent offsite to the Gallia County Landfill, located in Bidwell, Ohio, approximately 28 miles from the plant. In 2008, the Gallia County Landfill accepted a total of 36,260 tons of solid waste; approximately 22,000 tons was from out-of-state sources. In 2009, AEP sent approximately 530 tons of solid waste to the Gallia County Landfill. The Gallia County Landfill has a remaining capacity of 612,524 tons, with an estimated remaining life of 14 years (OEPA, 2010b).

AEP has a solid waste recycling program in place that identifies solid wastes for recycling and proper management of these wastestreams. Solid waste that is recycled includes paper, aluminum cans, spent fluorescent light bulbs, used oil, and non-hazardous solvents (e.g., paint and parts washer solvents). These materials are sent offsite to Heritage Crystal Clean in Indianapolis, Indiana (used oil and non-hazardous solvents), Green Lights, Inc. in Charleston, West Virginia (spent fluorescent light bulbs), and other licensed facilities as appropriate for each waste stream.

West Virginia considers solid waste management a local responsibility. The state has 55 counties and 50 solid waste authorities, with 19 permitted solid waste landfills. Within West Virginia, 48 of the counties have their own solid waste authority; the other 7 counties share 1 of 2 regional solid waste authorities. The state's landfills are permitted to receive up to approximately 3.8 million tons of waste per year. For fiscal year 2008, actual waste tonnage was 47.9 percent of the total annual capacity (WVSWMB, 2009).

West Virginia has designated solid waste management sheds, or "wastesheds," based on geographical proximity of counties and their local solid waste management needs. The project would be located in Wasteshed H (WVSWMB, 2009). There are three permitted solid waste landfills located in Wasteshed H, including the Charleston Municipal Landfill, Disposal Services, Inc. landfill, and Allied Waste Sycamore Landfill. Each of these landfills is permitted to receive approximately 18,000 to 20,000 tons per month, or 217,800 to 240,000 tons of solid waste annually (Table 3.13-1). The Charleston Municipal Landfill receives up to 95 percent of its permitted limit each month, while Disposal Services and Allied Waste Sycamore Landfill receive 59 percent and 28 percent, respectively, of their permitted limit on a monthly basis. As shown in Table 3.13-1, the remaining life of the landfills is between 13 years and 37 years.

Table 3.13-1. Landfill Capacity and Projected Lifespan

Landfill Name	Permitted Limit (tons/month)	Actual Quantity Received (tons/month)	Capacity Used (percent)	Approximate Remaining Life of Landfill
Charleston Municipal Landfill	18,150	17,293	95	13 years
Disposal Services, Inc. Landfill	20,000	11,791	59	37 years
Allied Waste Sycamore Landfill	20,000	5,666	28	37 years

Hazardous Waste Treatment, Storage, Disposal and Recycling Facilities

The Mountaineer Plant is located in EPA Region 3 and is regulated as a large-quantity generator of hazardous waste (EPA Identification Number WVD 980554463). Large-quantity generators produce more than 2,200 pounds (1,000 kilograms) of hazardous waste or more than 2.2 pounds (1 kilogram) of acute hazardous waste per calendar month. The WVDEP is designated as the lead agency for West Virginia hazardous waste management and is also the authorized enforcement agency for the regulation of hazardous waste.

Hazardous waste currently generated at the existing Mountaineer Plant is primarily purge water from the condenser associated with the PVF. Treatment and disposal facilities for hazardous waste are not available locally. Currently, the PVF purge water waste generated is transported by truck to the Vickery Deepwell Injection facility, located in Vickery, Ohio, approximately 225 miles from the plant. The Vickery facility is owned and operated by Vickery Environmental Inc., a Waste Management, Inc. subsidiary. This facility is permitted by the State of Ohio to use deep well injection to dispose of both hazardous and non-hazardous liquid industrial wastes. Hazardous waste generated at the plant is stored in 55-gallon drums in a 90-day hazardous waste storage area, which is located in a fully enclosed pre-engineered metal building equipped with a curbed concrete floor.

3.13.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to materials and waste management in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.13.1.3.

3.13.3.1 Construction Impacts

Construction Materials

Construction materials and specialized construction equipment required by the project are available within the ROI. These materials would be delivered by truck, rail, or barge to the Mountaineer Plant, with the exception of liquid materials, such as lubricants, transmission fluids, and oil, which would be transported via truck or rail. Construction material storage areas would be located on AEP property and fencing would restrict access, as appropriate. The storage of lubricants, transmission fluids, oils, etc. for the operation and maintenance of equipment at the work sites during construction would be minimized to the extent practicable. These materials would be stored in 55-gallon or smaller containers. All liquid material storage areas would have secondary containment and would be stored in a manner to minimize stormwater contact.

Prior to commencing construction of the project, AEP would develop and implement a standard operating procedure for fueling and maintaining vehicles to prevent potential spills and would update its existing Mountaineer Plant SPCC Plan. Qualified individuals would be trained in the use of the SPCC Plan and appropriate spill kits would be present at each work site. In addition, as discussed in Section 3.6, Surface Water, AEP would obtain an NPDES construction stormwater general permit and update its SWPPP.

New sources of construction materials and operational supplies would probably not be required to support the project. The capacity of material suppliers in the ROI should not be impacted. Construction materials should be readily available within the 50-mile ROI. Some specialized equipment may be required from the national ROI; however, it is expected that this equipment would be readily available. As a result, the impact to construction material resources and suppliers would be negligible.

Waste Management

Construction of the project would generate solid waste streams, which would predominantly include site-clearing vegetation, soils, and debris (i.e., organic land clearing debris); used lube oils; surplus materials; empty containers; construction and demolition (C&D) debris; spent hydrostatic testing water; general office trash; and sanitary waste. These waste streams are addressed in the remainder of this section. Table 3.13-2 lists the anticipated solid waste streams and estimated quantities to be generated by construction of the project, as well as associated receiving facilities likely to be used. Surplus and waste materials would be recycled to the extent practicable; the type and quantities of materials to be recycled is not known at the current level of engineering and design.

Organic land clearing debris (e.g., vegetation, shrubs, etc.) would be chipped or shredded onsite and used as mulch to support soil stabilization and to promote growth of ground cover in temporarily disturbed areas within the proposed pipeline ROWs and injection well sites. The chipped or shredded organic land clearing debris would be stored onsite until ready for use. Excess cut material from the proposed CO_2 capture facility would be used as grading or fill material on AEP property. Cleared debris that could not be reused would be appropriately disposed of in a licensed landfill. Poor quality timber would be chipped and used on AEP property within ROW, to the extent possible. Marketable timber would typically be harvested in accordance with landowner/tenant agreements. Otherwise, cleared debris would be appropriately disposed of in a licensed landfill. During excavation, topsoil would be removed and temporarily stored onsite separately from other excavated material. Topsoil would be stored in a manner such that it would not erode. Excavated topsoil would be replaced as the uppermost soil layer following pipeline construction. Organic material removed for the construction of the upgrades to the existing barge unloading area would be used as fill material, which would be placed on AEP property immediately adjacent to the cut area.

Routine operation and vehicle maintenance during construction activities would generate used rags, used oil, spent cleaners, and used hydraulic oil. These wastes would be collected in appropriate containers for recycling or disposal at offsite licensed recycling or waste facilities.

Other non-hazardous wastes generated during construction would include worker-generated sanitary waste and common construction site solid waste (e.g., paper, plastic, aluminum, cardboard). As discussed in Section 3.15, Utilities, sanitary waste would be hauled offsite and disposed of at the New Haven Sanitary Waste Facility (NHSWF). Non-hazardous construction wastes and common office trash would likely be landfilled offsite at the Gallia County Landfill. Paper, plastic, aluminum, and cardboard could be collected and sent to an offsite recycling facility.

In addition to the waste streams previously described, construction of the CO_2 capture facility would generate C&D debris, which is defined by EPA as waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures. Construction and demolition debris generated by the project would be recycled to the extent practicable; otherwise, the debris would likely be landfilled offsite at the Gallia County Landfill. It is estimated that C&D wastes generated at the CO_2 capture facility would range from 40 cubic yards to 480 cubic yards per month, with an average of 200 cubic yards generated monthly.

Hydrostatic pressure testing (hydrotest) water would be generated during pipeline construction. Hydrotest water would be reused for subsequent pressure tests, if practicable. Spent hydrotest water would be tested to determine if it exhibits hazardous characteristics. If hazardous, the hydrotest water would be sent offsite for proper treatment and disposal; if non-hazardous, the hydrotest water would be discharged in accordance with the project-specific stormwater permit.

At the injection well sites, drill cuttings, drilling mud, and brine water would be generated during well construction. Drill cuttings would be collected in constructed temporary lined mud pits located at the injection well site. Any brine removed would also be contained in the mud pits in accordance with an NPDES permit. The brine and light sediment would be pumped into trucks and hauled offsite for disposal by a licensed vendor within the ROI. Drill cuttings and excess drilling mud collected in the mud pits would be stabilized and transported offsite for proper disposal at a licensed landfill.

Table 3.13-2. Construction-Related Waste Stream Estimates

Waste Stream	CO_2 Capture Facility[a] (cubic yards)	Pipeline Corridors (Including Temporary Road Construction) (cubic yards)	Injection Well Sites (cubic yards)	Receiving Facility
Organic land clearing debris	13,431	140,800	38,720	AEP Property[b] or Offsite Landfill
Cut material and drill cuttings (soil/rock)	70,664	75,093	24,000	AEP Property[a] or Offsite Landfill
Solid waste[c,d]	8,560[e]		2,160[f]	Gallia County Landfill

[a] The proposed upgrades to the barge unloading area would involve approximately equal cut to fill volumes, such that there would be no anticipated need for offsite disposal.
[b] Organic material from clearing would be shredded and spread out over the ROW as mulch to support soil stabilization and growth of ground cover. Drill cutting material would be disposed of at onsite mud pits.
[c] Solid waste includes general garbage and C&D waste that cannot be reused onsite as fill material.
[d] Used oil and lubricants would be recycled at an offsite licensed recycling facility.
[e] Total solid waste generated from 2013 to 2015.
[f] Assumes that 120 cubic yards per well and that 6 injection wells and 12 monitoring wells would be constructed.

Solid waste that cannot be reused or recycled would be landfilled offsite. The Gallia County Landfill would most likely be used for disposal of solid waste from construction. However, there are several nearby alternate solid waste landfills within 170 miles of the Mountaineer Plant that could also accept solid waste from construction, including the Charleston Municipal Landfill, Disposal Services, and Allied Waste Sycamore Landfill, which are permitted and operational in Wasteshed H. These landfills have projected lifespans beyond the proposed construction schedule and are operating at approximately 57 to 95 percent of permitted capacity per month (see Table 3.13-1) (WVSWMB, 2009). The Charleston Municipal Landfill and Disposal Services are also permitted to accept C&D debris (WVDEP, 2006d; WVDEP, 2009e; WVSWMB, 2009). Another permitted C&D debris facility is located in Pomeroy, Ohio (Jeffers C&D Disposal Facility), approximately 10 miles from the Mountaineer Plant (OEPA, 2010c). Liquid waste would be sent offsite to the Vickery Deepwell Injection facility, located in Vickery, Ohio, approximately 225 miles from the plant.

The impact from disposal of solid waste streams generated from clearing associated with construction of the project would be considered negligible as: (1) AEP would recycle or reuse these wastes on AEP property whenever possible; and (2) the Gallia County Landfill has available capacity to accept solid waste that cannot be reused or recycled. In the event that the Gallia County Landfill could not accept all of the project's construction solid waste, there are several alternate landfills available within the ROI with unused capacity. Further, generation of these waste streams would be short-term (during construction).

The impact would be negligible and short-term for disposal of drill cuttings and treatment of the brine generated during the construction of the injection and monitoring wells, as there are existing receiving facilities for this material within the ROI. Sufficient landfill capacity exists within the ROI to accept any non-reusable wastes generated by these activities.

Although the amount of waste generated during construction would vary depending on the number of injection well sites and the length of pipeline corridors, the potential impact would be negligible as most waste generated would be reused in-place or landfilled offsite at facilities with adequate capacity to accept the volume of waste generated.

3.13.3.2 Operational Impacts

CO_2 Capture Facility

The primary chemicals that could be used by the proposed CO_2 capture facility include anhydrous ammonia, aqueous ammonia, and sulfuric acid. All are readily available within the national ROI, and are likely available within the regional ROI. The closest source of anhydrous ammonia and aqueous ammonia is located in Mount Hope, West Virginia, approximately 115 miles from the Mountaineer Plant. Multiple additional sources are available within the national ROI. A minor increase in the amount of fuel, oil, and solvents is expected to support the new equipment and operations.

Table 3.13-3 presents a summary of materials required to support the CO_2 capture facility, including storage vessels and secondary containment features, as well as the potential rate of use during operation. Unloading areas would be equipped with secondary containment, including curbed and sloped containment berms.

The materials listed in Table 3.13 are present at the existing Mountaineer Plant. The expanded use of these materials due to the project would increase the risk of a release to the environment. The design and engineering of reagent and other chemical feed storage systems would include adequate valving, interlocks, safety systems (e.g., fogging, foaming, secondary containment berms, spill prevention, instrumentation, ambient monitoring systems, alarms, etc., as necessary) to ensure safe operation, maintenance, and reliability for the life of the equipment. In addition, process drains, sumps, and secondary containment structures would be installed to capture any inadvertent spills, leaks, and washdown of the area and/or equipment to prevent release to the environment. AEP would incorporate the safe handling and storage of these materials into a revised Integrated Contingency Plan to minimize the potential for a release. The impact from the storage and use of these chemicals would be considered minor. These materials are commercially abundant and widely used in industry and agriculture. Therefore, their use would not impact local or regional users or suppliers.

The proposed CAP process would produce up to 2,500 lbs/hr of dry ammonium sulfate by-product. This by-product would be stored onsite and sold to local and regional agricultural suppliers. Initial discussions between AEP and local distributors indicate this by-product could be sold. If no buyer is available, the by-product would require additional processing to produce a solid product suitable for disposal at AEP’s Little Broad Run Landfill. If the ammonium sulfate can be used for commercial purposes, this would result in a long-term beneficial impact, as additional energy and materials would not be required to produce this common and useful commercial product. If the by-product is landfilled, the Little Broad Run Landfill has available unused capacity and a relatively long-life span (lasting through 2038) that can accept this non-hazardous material (as a solid). The impact under this scenario is considered moderate because of the potential long-term disposal requirement.

Industrial wastewater would be generated by the CO_2 capture facility, as described in Section 2.3.3.4. The current onsite WWTP may have sufficient capacity to handle additional process flow from the CAP facility. However, should the existing system prove incapable of providing the necessary capacity, process water from the CO_2 capture facility would be treated by a proposed new industrial WWTP. AEP estimates that less than 0.01 mgd of sludge would be generated from the CO_2 capture process, which would be a 7 percent increase over the 0.14 mgd of sludge currently generated. This sludge material would be disposed of in the existing AEP Little Broad Run Landfill. If WWTP sludge does not meet the current landfill’s permit specifications, AEP would have to modify its landfill permit via the WVDEP or identify another disposal option. As AEP is complying with the WVDEP for ongoing landfill improvements and permit modification, if required, would likely be approved by the WVDEP, and given the relatively small amount of waste that would be generated, the impact would be negligible.

Table 3.13-3. Potential Material Use and Storage during Operation

Material	Estimated Usage	Storage Inventory/ Storage Vessel	Secondary Containment
Reagent Option 1: Anhydrous Ammonia System (100 percent)	650 to 850 lbs/hr	28,739 gallons (146,569 lbs): Two 17,000-gallon (carbon steel) ASTs outdoors	Containment berm with fogging system
Reagent Option 2: Aqueous Ammonia System (29 percent)	2,500 lbs/hr	54,308 gallons (396,448 lbs): One 55,000-gallon (carbon steel) AST outdoors	Containment berm
Anhydrous Ammonia (100 percent) – Backup for Reagent Option 2 (startup/ upset conditions)	Varies based on upsets (under normal conditions, no usage)	28,739 gallons (146,569 lbs): Two 17,000-gallon (carbon steel) ASTs outdoors	Containment berm with fogging system
Anhydrous Ammonia – Refrigerant	80,000 lbs/yr	800,000 lbs in closed refrigeration system with multiple vessels. Largest single vessel approximately 250,000 lbs.	Containment berm with fogging system
Ammonium carbonate/bicarbonate solution (auxiliary storage tank)	NA[a]	700,000 gallons: One carbon steel AST	Containment berm and/or containment pond
Sulfuric acid (93 percent by weight)	750 to 900 lbs/hr	45,000 gallons (675,000 lbs): One 45,000-gallon (carbon steel) AST outdoors	Containment berm for tank and pump Adjacent truck unloading area curbed and sloped to tank containment berm
Ammonium sulfate (15-35 percent by weight)	NA[a]	150,000 gallons: Four (carbon steel) ASTs (37,500 gallons each) or two (carbon steel) ASTs (75,000 gallons each) outdoors	Containment berm

[a] Materials that are generated and stored, but not consumed.
AST = aboveground storage tank; lbs/hr = pounds per hour; NA = not applicable

Non-hazardous solid waste would also be generated at the CO_2 capture facility during operations. This solid waste would mainly include miscellaneous facility (worker) trash, including paper, cardboard, aluminum, and glass. AEP estimates the CO_2 capture facility would generate less than 10 cubic yards of general trash per month. Solid waste containers would be sized appropriately to minimize the need for waste transportation-related trips to and from the Mountaineer Plant. The impact is considered minor because recycling of some materials as a BMP would decrease the volume requiring landfilling. In addition, regional landfills have sufficient capacity (see Table 3.13-1) to accept this small additional amount of waste per month over the 20-year operational life of the project.

Additional liquid streams would be generated from the CAP process, including purge streams from the flue gas cooling and ammonia stripping processes, cooling tower blowdown, and maintenance activities (e.g., washdown). Approximately 275 gpm of liquid streams would leave the CAP process under the worst-case flow rate. The liquid streams would be re-used within the CAP process or within the existing plant systems; the remaining liquid (if any) would be treated as required for discharge or properly disposed. The impact is considered minor as AEP would construct a new WWTP or use existing WWTP capacity for treatment of these waste streams.

Infrequently, off-specification by-product waste would be generated from the CAP process. This type of waste would be generated from long-term maintenance of process equipment (e.g., absorber vessels, regenerator, stripping systems, etc.) to replace packing, internals, and components. The material removed or waste generated as part of this required maintenance would be disposed of properly and is not expected to be hazardous. Routine maintenance of process components (e.g., pumps, valves, etc.) is not expected to generate large amounts of solid waste. Any waste generated would be properly disposed, and is not expected to be hazardous. This impact is therefore considered minor.

In the event of a process upset, maintenance may be required, which could produce a waste product not considered in the maintenance scenarios previously described; such wastes may or may not be hazardous. The waste material generated as a result of these activities would be handled according to applicable laws and regulations, plant operations and maintenance standards, in a similar manner as the waste streams previously noted. This impact is therefore considered minor.

The operation of the CO_2 capture facility would have the potential to increase the amount of hazardous waste generated at the plant. However, similar wastestreams would be generated under the project as what is currently being generated. The additional hazardous waste generated would not have any impact on the Mountaineer Plant's generator status (i.e., would remain a large-quantity generator of hazardous waste) and the plant would continue to be regulated under the same federal, state, and local regulations. Hazardous waste would be stored in the plant's existing hazardous waste storage area.

Amine-Based Capture System Feasibility Study

An amine-based capture technology would typically require the use and storage of an aqueous amine solution, as well as corrosion inhibitors. It would not likely require the use and storage of anhydrous ammonia. In general, amines are caustic, corrosive, and smell similar to ammonia. There are many different corrosion inhibitors that could be used, including salicyclic acid as well as vanadium, antimony, copper, cobalt, tin and a variety of sulfur-based compounds. The most common inhibitors are vanadium compounds, particularly sodium metavanadate (Thitakamol, 2006). Quantities of process chemicals necessary to support an amine-based capture system are unknown at this time. The feasibility study would evaluate this issue in more detail. Available literature indicates that the amine solution might be consumed at a rate of 1 to 4 pounds (0.35 to 2.0 kilograms) per metric ton of CO_2 captured (Bailey, 2005). At this rate, a system capturing 1.5 million metric tons per year would require approximately 600 to 3,000 tons (540 to 2,700 metric tons) of amines to replace those lost through emissions and degradation.

An amine based capture system would have the potential to generate amine waste. Typically, the composition of amine waste would include spent amine solvent, amine degradation products, and corrosion inhibitors (Thitakamol, 2007). A typical CO_2 capture plant using an amine-based solvent with a capacity to capture 1 million metric tons of CO_2 annually might be expected to generate 330 to 3300 tons (300 to 3,000 metric tons) of amine waste annually (Bellona, 2009). There is still considerable uncertainty about the degradation products that would result from a large-scale amine-based capture system. Available literature indicates that potential degradation products could be considered hazardous waste due to corrosivity and toxicity. If so, such wastes would have to be transported to a licensed hazardous waste disposal facility, and would have to be properly managed. The feasibility study would evaluate this issue in more detail.

Pipeline Corridors

Along the pipeline corridors during operation, additional waste generated would include organic land clearing debris as needed during maintenance of these areas. Vegetation cut along the corridors during long-term routine maintenance would likely be reused as mulch or compost on AEP property and would not require landfilling.

Injection Well Sites

Long-term maintenance of wells would include well workover, wellhead maintenance, acidizing, swabbing, and stimulation (see Section 2.3.5.4). Wastes generated during the maintenance of these wells would consist of equipment taken out of service during maintenance. During swabbing and hydraulic stimulation operations, an acid brine mixture could be generated that would be would be pumped into trucks and hauled offsite for recycling by a licensed vendor within the ROI.

Solid waste generated during well maintenance activities would be less than 1 cubic yard per event and would be landfilled offsite. Liquids generated during well maintenance would be treated offsite by a licensed facility. Suitable facilities are available within the ROI for treatment and disposal of these wastes. Although the amount of waste generated during operations would vary depending on the number of injection and monitoring well sites, the potential impact would be minor.

3.13.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to materials and waste management. The beneficial long-term generation of ammonium sulfate by-product in the CAP process would not be realized, resulting in ongoing energy and materials to produce this product commercially within the ROI.

3.14 HUMAN HEALTH AND SAFETY

3.14.1 Introduction

This section identifies and describes potential impacts to human health and safety associated with the construction and operation of the Mountaineer CCS II Project. The health and safety impacts are evaluated in terms of the potential risks to workers and the public, including the risks from accidents or intentional destructive acts that could result in the release of hazardous material to onsite or offsite locations. The level of risk is estimated based on the current conceptual design of the project, applicable DOE Guidance (DOE, 2002, 2004), applicable safety and spill prevention regulations, and expected operating procedures. Additional information and a more detailed analysis of potential impacts that could result from the release of CO_2 are presented in Appendix G.

Federal, state, and local health and safety regulations, as well as industrial codes and standards, would govern work activities during construction and operation of the project to protect the health and safety of the workers and the public.

3.14.1.1 Region of Influence

The ROI for human health, safety, accidents, and intentional destructive acts, was determined based on worst-case (catastrophic) release scenarios and the area that could be impacted by such releases. The ROI for potential releases from operation of the CO_2 capture facility was determined to be 4.25 miles from the plant boundary. This distance was based on the maximum predicted distance for potential adverse health effects that could result from the accidental release of ammonia from the site. The ROI for the CO_2 pipeline was considered to be within 1.5 miles of the pipeline ROW. This is the maximum distance at which adverse effects could occur; the actual distance could be substantially less since the potential distance fluctuates with pipeline length and associated release volumes. The ROI for the injection wells would be limited to approximately 600 feet from the well. A ROI of 3 miles was used for the subsurface CO_2 plume based on a preliminary analysis conducted by Battelle that indicated this would be the maximum distance for migration in the Copper Ridge Formation, based on as many as eight injection wells after 20 years of operation (Battelle, 2010). Data gathered during the geological characterization study will enable the project team to more accurately model the CO_2 plume to support the UIC permit application and regulatory approval process.

Potential accidental releases during the transport of hazardous materials were also considered. The ROI for these types of releases was considered to be within 4.5 miles of the rail line corridor, and 1.5 miles of roadway corridors. These distances correspond to the maximum distances at which adverse effects could occur for the CO_2 capture facility and pipeline corridors, respectively.

3.14.1.2 Method of Analysis

For chemical hazards, DOE considered a full range of potential accident scenarios, including the worst-case releases. Potential accident scenarios were considered for each aspect of the project including the CO_2 capture facility, CO_2 pipelines, CO_2 injection wells, and the formations used for the injection of CO_2. The potential impacts from intentional destructive acts were evaluated based on the analysis of the worst-case release from these scenarios.

Accidents considered by DOE address concerns related to the potential release of ammonia and CO_2 and related health effects that could occur from exposure. Each release scenario was carefully reviewed to determine the predicted frequency for which such an event could occur. DOE considered engineering design and controls, as well as available industry safety statistics when determining the predicted frequency for each type of accident and release. The frequency of an accident is the chance that the accident might occur and is typically discussed in terms of the number of occurrences over a period of time that an accident may occur based on previous industry experience. For example, the frequency of occurrence for an accident that can be expected to happen once every 50 years, or one accident divided by the 50-year period, is $2x10^{-2}$ per year. Based on DOE's review, each accident was classified into one of the following frequency categories:

- **Possible**: Accidents estimated to occur one or more times in 100 years of facility operations (frequency $\geq 1 \times 10^{-2}$ per year).
- **Unlikely**: Accidents estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2} to 1×10^{-4} per year).
- **Extremely Unlikely**: Accidents estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1×10^{-4} to 1×10^{-6} per year).
- **Incredible**: Accidents estimated to occur less than one time in 1 million years of facility operations (frequency $< 1 \times 10^{-6}$ per year).

Potential health effects were considered for both workers and the general public based on modeling results. Comparisons were made between potential exposure concentrations and health criteria published by EPA, OSHA, and other industry groups (e.g., American Industrial Hygiene Association [AIHA]) to determine potential health effects. DOE used the following categories to characterize the potential range of health effects that could occur for a particular accident:

- **Transient and reversible adverse effects** – headache, dizziness, sweating, and/or vague feelings of discomfort
- **Irreversible adverse effects** – breathing difficulties, increased heart rate, convulsions, and/or coma
- **Life-threatening effects**

Potential exposure concentrations at receptor locations were calculated by running industry standard or EPA-approved air quality computer models. Each accident (release) scenario was evaluated through computer modeling to determine exposure concentrations at various distances from the point of release. For ammonia related releases, air modeling was initially conducted using two different models (RMP*COMP and ALOHA) to determine the distances for different exposure levels and related potential for adverse health effects.

The AIHA has developed the Emergency Response Planning Guidelines (ERPG) acute toxicity endpoints to identify levels of exposure to toxic chemicals that have the potential to result in adverse effects as a consequence of the exposure. There are three different levels of ERPGs:

- **ERPG-1** – The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing other than mild **transient adverse health** effects or perceiving a clearly defined objectionable odor.

- **ERPG-2** – The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing **irreversible** or other serious health effects or symptoms that could impair an individual's ability to take protective action.
- **ERPG-3** – The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing **life-threatening health effects**.

Additional air modeling was conducted using EPA's Dense Gas Dispersion Model (DEGADIS) to determine the distances and area within which adverse effects could occur. The exposure criteria used were the acute toxicity endpoints defined by ERPG levels 1, 2, and 3 (AIHA, 2010). The results of the modeling were then evaluated against population data (census block population densities) for the areas that could be impacted by a release to estimate the number of individuals potentially affected and the types of effects they could experience. DOE also considered various atmospheric (weather) conditions as part of this analysis. In addition, the SLAB model (Ermak, 1990) and the pipeline-walk methodology (see Appendix G) were used to evaluate health effects resulting from potential releases of CO_2 from the pipelines and injection wells during operation.

Potential worker safety impacts were estimated based on national workplace injury, illness, and fatality rates. These rates were obtained from the U.S. Bureau of Labor Statistics (USBLS) and are based on similar industry sectors. The rates were applied to the numbers of employees anticipated during construction and operation of the project. From these data, the projected numbers of total recordable cases (TRCs), lost work day cases (LWDs), and fatalities were calculated.

3.14.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to human health and safety, based on whether the Mountaineer CCS II Project would directly or indirectly increase

- worker health risks due to industrial accidents, injuries, or illnesses during construction and normal operating conditions;
- public health risks due to accidental releases of anhydrous and/or aqueous ammonia at the CO_2 capture facility;
- public health risks due to accidental releases associated with captured CO_2 transport and local geologic storage activities;
- public health risks due to accidental release during anhydrous or aqueous ammonia transport to the CO_2 capture facility; or
- public health risks due to intentional destructive acts.

3.14.2 Affected Environment

This section presents affected environment data for health and safety that generally consists of those populations that could be exposed to potential hazards resulting from the construction and operation of the project. In addition, relevant occupation industry and accident data for similar industries is presented.

3.14.2.1 CO_2 Capture Facility

As shown in Figure 3.14-1, the ROI for potential releases from the CO_2 capture facility (4.25 miles from the facility) includes the towns of Hartford and New Haven, West Virginia, as well as Syracuse and Racine, Ohio. Hartford and New Haven are approximately 2 to 3 miles to the west and northwest within Mason County and are included in US Census Tract 9548 (HUD, 2010). Syracuse and Racine are approximately 2.5 miles to the northwest and 1.5 miles southeast, respectively, within Meigs County and are included in US Census Tracts 9645 (Syracuse, Ohio) and 9646 (Racine, Ohio) (HUD, 2010).

Census Tract data, including population and sensitive receptor information, are presented in Table 3.14-1 from the 2000 U.S. Census. Sensitive receptors include young children, the elderly, and those living in poverty (inadequate access to healthcare). Two elementary schools and six licensed daycare providers are located within the ROI.

Table 3.14-1. Capture Facility ROI Demographics

Tract	2000 Population[a]	Sensitive Receptors		
		Persons in Poverty[b]	Children Under 5 years old[b]	Adults 65 and older[b]
9548	6,909	1,100	416	1,128
9645	3,127	727	201	592
9646	3,385	620	172	464

[a] Qualified Census Tract Table Generator. Source: HUD, 2009.
[b] DP-1: Profile of General Demographic Characteristics: 2000. Source: Census, 2000.
ROI = region of influence

As shown on the wind rose in Figure 3.1-2 of Section 3.1, Air Quality and Climate, the predominant wind directions are from the southwest, with significant winds also present at times from the west (see also Table 3.1-8 in Section 3.1, Air Quality and Climate), which are not in the direction of population centers. New Haven, West Virginia, with a population of 1,510, is located approximately 2 miles west of the facility, and as shown in Table 3.1-8, winds from the east (i.e., towards the west) occur about 5 percent of the time. Hartford, West Virginia and Syracuse, Ohio are located approximately 3 miles to the west-north-west and 2 miles to the north-west of the facility, respectively. The combined population of these 2 towns is 1,375 people, and as shown in Table 3.1-8 winds from the east-south-east (i.e., towards west-north-west) occur about 6 percent of the time, while winds from the southeast (i.e., towards northwest) occur about 6 percent of the time. The fourth population center in the ROI is Racine Ohio, with a population of 740. Racine is located approximately 1.5 miles to the southeast of the facility, and as shown in Table 3.1-8, winds from the northwest (i.e., towards the southeast) occur about 5 percent of the time.

3.14.2.2 Pipeline Corridors and Injection Well Sites

Potential CO_2 pipeline corridors and injection well sites are described in detail in Sections 2.3.4 and 2.3.5, respectively. Figure 3.14-1, illustrates the general locations of these features in relation to population densities in the surrounding areas. The population densities are based on the 2000 U.S. Census. The 2000 U.S. Census was used because it provides data for smaller tracts, versus larger census block data that would present population density for an overly large area.

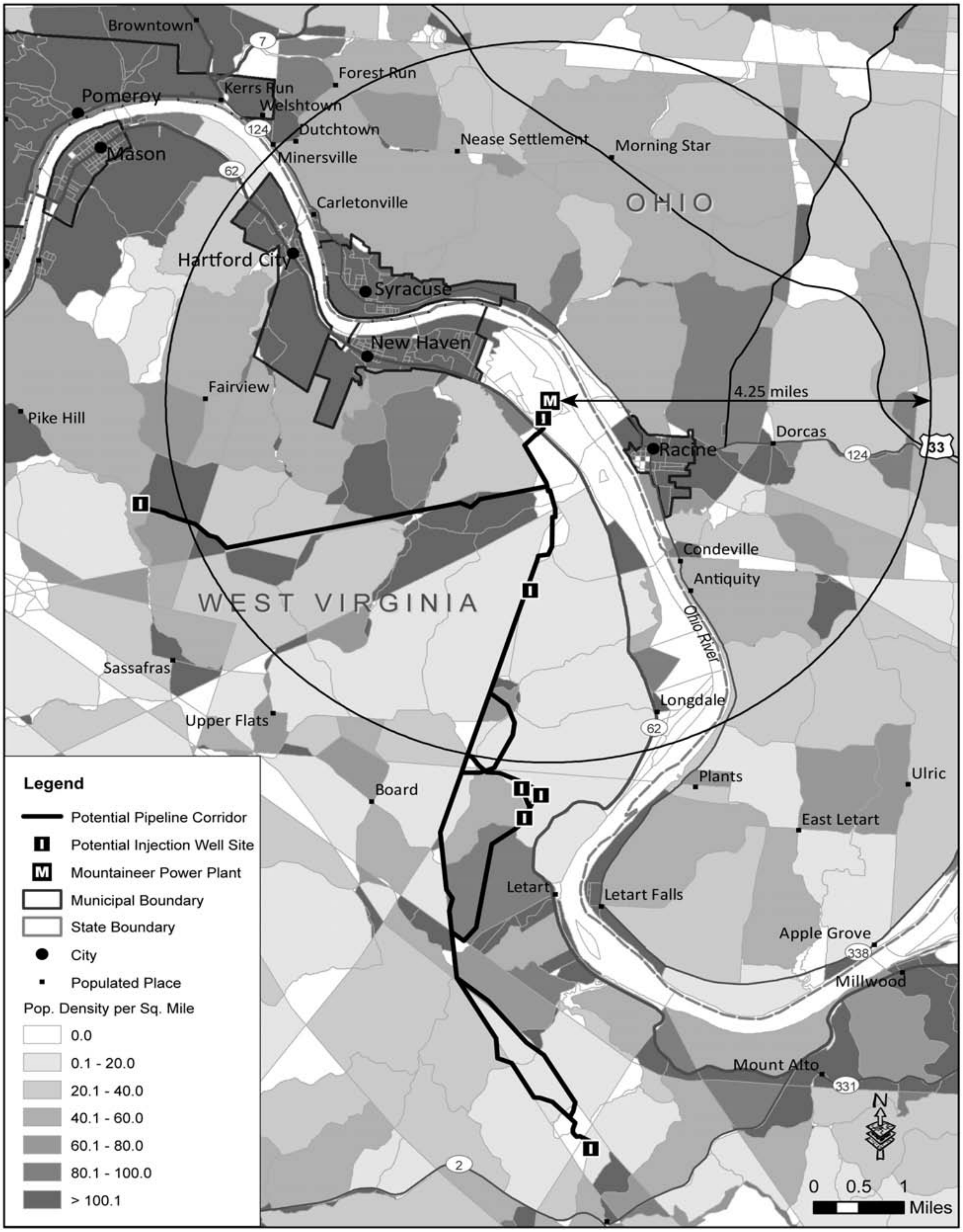

Figure 3.14-1. Population in Vicinity of Potential Pipeline Routes and Injection Wells (2000 U.S. Census)

3.14.2.3 Toxicity of CO_2 and Ammonia

Table 3.14-2 provides health risk criteria for workers and the public for exposure to CO_2 and ammonia. Table 3.14-3 provides the concentrations of ammonia that are not likely to cause adverse effects to humans (including sensitive subgroups) for longer exposure periods (up to a lifetime). Long-term criteria for CO_2 have not been established because CO_2 is an acute health hazard, rather than a chronic health hazard.

Health effects from inhalation of high concentrations of CO_2 gas can range from headache, dizziness, sweating, and vague feelings of discomfort to breathing difficulties, increased heart rate, convulsions, coma, and possibly death.

The OSHA permissible exposure limit (PEL) and American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for CO_2 (based on an 8-hour time-weighted average) are both 5,000 ppm. The PEL is the legal limit established by OSHA for exposure of an employee, expressed in terms of a time-weighted average, which is the average exposure over a specified period of time. This means that for limited periods a worker may be exposed to concentrations higher than the PEL, so long as the average concentration over 8 hours remains lower. The TLV is a concentration at which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects. The ACGIH Short Term Exposure Limit (STEL) is 30,000 ppm (3 percent in air). The STEL is a concentration that it is believed workers can be exposed routinely for a short period of time without suffering significant effects, but it should not occur more than 4 times per day and not longer than 15 minutes each time.

Anhydrous ammonia is a liquid under pressure with a boiling point of -28°F. Ammonia has a pungent, suffocating odor (HSDB, 2010), with an odor threshold of 5 ppm (Amoore et al., 1983; ATSDR, 2010). Ammonia vapor is a strong irritant with a vapor density of 0.6 when compared to air, which means that small releases would dissipate quickly. The lower explosive limit for ammonia is 15 percent and the upper explosive limit is 28 percent. The OSHA PEL for ammonia is 50 ppm and the ACGIH TLV is 25 ppm with a STEL of 35 ppm.

Ammonia is hazardous by all routes of exposure (inhalation, skin contact, and ingestion). Ammonia gas is capable of causing severe eye damage, pulmonary edema, inflammation and edema of the larynx, and death from spasm (HSDB, 2010). Effects on the respiratory tract include inflammation, which can lead to wheezing, shortness of breath, and chest pain. Inhalation of ammonia vapor from concentrated, industrial strength sources may cause burns to the respiratory tract. Eye exposure can cause symptoms ranging from tearing, inflammation, and irritation to temporary or permanent blindness (ATSDR, 2004). A single exposure to a high concentration of ammonia gas reportedly causes residual chronic bronchitis. Chronic obstructive pulmonary disease occasionally develops as a consequence of fibrous obstruction of the small airways (HSDB, 2010). In addition, blood pressure and pulse may increase following exposure (ATSDR, 2004).

3.14.2.4 Occupational Injury Data

Occupational injury and fatality data from the USBLS are presented in Tables 3.14-4 and 3.14-5. This data provides the injury/illness and fatality rates for utility-related construction and natural gas distribution. These rates are expressed in terms of injury/illness per 100 worker-years (or 200,000 hours) for TRCs, LWDs, and fatalities. Note these rates are used for estimating potential impacts. However, the characteristics and associated pipeline risks are different for CO_2 and natural gas. Table 3.14-6 summarizes safety incidents between 1988 and 2008 involving natural gas and CO_2 pipelines in the U.S., of which CO_2 pipelines have not resulted in any fatalities (OPS, 2009).

Table 3.14-2. Potential Health Effects from Exposure to CO_2 and Ammonia

Gas	Potential Health Effects	Health Protective Criteria Concentrations – Public[a] (ppmv)	Health Protective Criteria Concentrations – Workers[b] (ppmv)	ERPG Criteria Concentrations Public[c] (ppmv)
CO_2	No health effects	Less than 5,000 (1 hour)	PEL: 5,000 (8 hours)	NA
	Adverse (e.g., headache, dizziness, sweating, vague feelings of discomfort)	5,000 to 30,000 (1 hour)		NA
	Irreversible adverse (e.g., breathing difficulties, increased heart rate, convulsions, coma)	Above 30,000 (1 hour)	IDLH: 40,000 (30 minutes)	NA
	Life-threatening	Above 40,000 (1 hour)		NA
Ammonia	No health effects	Less than 30	PEL: 50 (8 hours)	Less than 30
	Adverse (e.g., skin, eye, throat irritation)	Above 30 (1 hour and 8 hours)		Above 30 (1 hour)
	Irreversible adverse (e.g., coughing, burns, lung damage)	Above 160 (1 hour) Above 110 (8 hours)	IDLH: 300	Above 150 (1hour)
	Life-threatening	Above 1,100 (1 hour) Above 390 (8 hours)		Above 750 (1 hour)

[a] Based on Protective Action Criteria (PAC) for exposure time of 1 hour or less established by DOE's Subcommittee on Consequence Actions and Protective Assessments (SCAPA, 2010) and EPA's Acute Exposure Guideline Levels (AEGL) for multiple time periods varying from 10 minutes up to 8 hours (EPA, 2010L).

- PAC-1, AEGL-1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience discomfort, irritation, or certain asymptomatic, non-sensory effects; however, these effects are not disabling and are transient and reversible upon cessation of exposure (DOE, 2010 and EPA, 2010L).
- PAC-2, AEGL-2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape (DOE, 2010 and EPA, 2010L).
- PAC-3, AEGL-3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death (DOE, 2010 and EPA, 2010L).

[b] Permissible exposure limits (PELs) are legally enforceable standards established by the U.S. Occupational Safety and Health Administration (OSHA, 2010). Immediately dangerous to life and health (IDLH) levels are recommended criteria established by the National Institute of Safety and Health (NIOSH, 2005), designed to allow a worker to escape within 30 minutes.

[c] Defined by the AIHA, ERPGs provide estimates for concentration ranges 'where a person may reasonably anticipate observing adverse effects as a consequence of exposure to the chemical in question.'

CO_2 = carbon dioxide; ERPG = Emergency Response Planning Guidelines; IDLH = immediately dangerous to life and health; NA = not applicable; PEL = permissible exposure limit; ppmv = parts per million by volume

Table 3.14-3. Longer Duration Criteria for CO_2 and Ammonia Not Likely to Cause Appreciable Health Risks to Humans

Gas	RfC (ppm)	Acute MRL (ppm)	Intermediate MRL (ppm)	Chronic MRL (ppm)
CO_2	None established	None established	None established	None established
Ammonia	0.14	1.7	None established	0.1

Sources: EPA, 2010m, n (acute and chronic MRLs); ATSDR, 2009 (NH_3 MRLs); EPA, 2010o (NH_3 RfC)

CO_2 = carbon dioxide; ppm = parts per million; RfC = reference concentration (estimates of daily inhalation exposure likely to cause no appreciable risk of deleterious effects to humans, including sensitive subgroups, during a lifetime); MRL = Minimal Risk Levels (estimates of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects for three different exposure periods: acute MRL for 1-14 days, intermediate MRL for >14 to 365 days, and a chronic MRL for 365 days and longer).

Table 3.14-4. Occupational Injury Data for Related Industries

Industry	2008 Average Annual Employment (thousands)	Total Recordable Case Rate (per 100 workers)	Lost Work Day Case Rate (per 100 workers)
Utility system construction	460.7	4.1	1.5
Non-residential construction	855.9	4.4	1.4
Oil and gas pipeline construction	107.7	2.2	0.9

Source: USBLS, 2009

Table 3.14-5. Fatality Data for Related Industries in 2008

Industry	Fatality Rate (per 100,000 FTE workers)
Utilities	3.8
Construction	9.6
Natural Gas Distribution	1.2

Source: USBLS, 2008

FTE = full-time equivalent

Table 3.14-6 shows safety incidents between 1988 and 2008 involving natural gas and CO_2 pipelines in the U.S. As shown, CO_2 pipelines have not resulted in any fatalities and the annual incident frequency is 0.23 per 621 miles (1,000 kilometers) (OPS, 2009). The major cause of pipeline failure is damage (puncture or rupture) during excavation of existing pipelines for repair or for new pipelines (OPS, 2010).

Table 3.14-6. Pipeline Safety Record in United States (1988 – 2008)

Pipelines	Natural Gas	CO_2
Length (miles)	307,254	3,468
Incidents	2,038	26
Fatalities	253	0
Injuries	224	1
Property Damage (in $M)	1,221.7	1.25
Incidents/621 miles/year	0.21	0.23

Note: Based on Office of Pipeline Safety Data through 4/2009.
CO_2 = carbon dioxide; $M = millions of dollars

3.14.2.5 Pipeline Safety Data

DOT's Office of Pipeline Safety administers and enforces the rules and regulations regarding CO_2 pipeline transport. States also may regulate pipelines under partnership agreements with the Office of Pipeline Safety. The rules are designed to protect the public and the environment by ensuring safety in pipeline design, construction, testing, operation, and maintenance. Risks associated with pipeline activities are determined to be low (IOGCC, 2005). However, in pipelines that carry captured CO_2 for injection, other gases may be captured and transported as well (e.g., ammonia), and could affect risks posed to human health and the environment.

Currently, there are over 497,000 miles of pipelines in the U.S. transporting natural gas, other petroleum products, and other hazardous liquids. Over 307,000 miles of these pipelines transport natural gas. There are 3,400 miles of CO_2 pipelines in the United States (OPS, 2009), of which about 3,000 miles are used for enhanced oil recovery projects (Parfomak et al., 2008). The characteristics and pipeline transportation risks for CO_2 and natural gas or petroleum products are different. For example, CO_2 is expected to be transported by pipeline as a supercritical fluid with a density of approximately 70 to 90 percent of that of liquid water. If a leak develops along a pipeline, a portion of the escaping fluid would quickly expand to a gas, while the remainder would form a solid (i.e., dry-ice snow). Carbon dioxide gas is about 50 percent heavier than air and would disperse horizontally following the ground contours. In contrast, natural gas in a pipeline is lighter than supercritical CO_2 and is more likely to disperse upwards. Natural gas is also highly flammable, which poses different risks compared to CO_2 which is not flammable.

3.14.2.6 Industrial Safety Data

DOE reviewed available accident data from chemical industry facilities to assess the frequency of occurrence of accidents. Accident data were reviewed by industrial sector, by chemical, by process, and by quantity stored based on a preliminary EPA analysis of chemical accident risk using RMP data (Belke, 2000). This analysis reviewed accident data from EPA's RMP database to determine frequency by chemicals and industry type and presented normalized data for accidents by number or processes and storage quantities. The EPA report indicates an accident rate of 1.4×10^{-2} accidents per year per million pounds of ammonia stored. However, the report does not provide detail on accident rates by accident severity or consequences.

DOE also reviewed accident rates for aqueous ammonia release scenarios presented in a report that estimated the risks of using aqueous ammonia for selective catalytic reduction units (CCPS, 1989). This report presented accident rates for various ammonia release scenarios using 1989 data derived from The Center for Chemical Process Safety. This data included the following frequencies: onsite truck release $2.2\text{x}10^{-6}$; loading line failure $5.0\ \text{x}10^{-3}$; storage tank failure $9.5\text{x}10^{-5}$; process line failure $5.3\text{x}10^{-4}$; and evaporator failure $1.5\text{x}10^{-4}$.

3.14.3 Direct and Indirect Impacts of the Proposed Action

3.14.3.1 Construction Impacts

The construction of the CO_2 capture facility would be typical for an industrial construction site within an existing plant boundary and would involve several types of heavy equipment and personnel necessary to erect the structures for the CO_2 capture facility. The occupational exposure risks would be correspondingly typical for a construction project. Construction equipment would include cranes, powered industrial lifts, compressors, welding equipment, scaffolds, trucks and trailers. Construction materials would consist of structural steel, concrete, piping, and earthen materials. Components would include ductwork, wiring, cables, insulation, fans, motors, and the components necessary to construct the facility. Construction would require a laydown area that would be within the property line of the facility. Because of the conventional nature of the activities, there are not expected to be significant airborne hazards present for the construction workers.

Construction of the CO_2 pipeline is expected to be similar to typical gas pipeline construction and would use comparable materials, equipment, and similar procedures to minimize potential worker exposures. Excavations would be constructed with proper shoring or lay back to reduce cave-ins and excavated soil would be stockpiled to minimize slumping into the excavation. If applicable, two means of egress would be provided for each excavation. Construction activities at the injection well sites would include the installation of the injection well and connecting the wells to the pipelines.

Installation of the injection wells would involve the use of drilling rigs and associated support equipment and vehicles. Noise levels during drilling would likely exceed occupational standards for the site workers, therefore requiring hearing protection. AEP would likely be required by WVDEP to install monitoring wells as part of the UIC permitting process for this project (see Section 2.3.5.2). Construction of each monitoring well would be completed using similar methods as the injection wells and potential impacts would be similar to those described for the construction of the injection wells.

According to 2008 data from the USBLS, the total nonfatal incident rate for utility system construction was 4.1 per 100 employees per year, with 1.5 lost time incidents per 100 employees per year (including restricted duty cases). Construction is expected to take approximately 32 months to complete and the number of construction personnel would vary depending on the construction activity. An estimated 13 to 16 OSHA recordable incidents would be anticipated during the construction of this facility based on the national incidence rates. An OSHA recordable incident is defined as a work related accident that results in lost time, work restriction, medical treatment or death. Based on fatality rates for construction and the number of construction personnel, the fatality rate would be well below 1 (less than 0.03) and no fatalities would be expected.

AEP would implement its existing Site Construction Safety Program for the project, which emphasizes risk identification and mitigation during pre-planning site activities to prevent accidents. Under this program, AEP would also develop and implement a hazardous communication program, monitoring procedures, a risk management program, site safety operating procedures, and process hazard analysis to ensure safety during the construction phase.

3.14.3.2 Operational Impacts

This section describes potential impacts to human health from physical and chemical hazards to workers and the general public that would be present during facility operation. In general, the impacts during normal operations of the project would be limited to workers directly involved in facility operation and maintenance. Under accident conditions, the health and safety of both workers and members of the general public around the site could be affected.

Ammonia

Either anhydrous ammonia or 29-percent aqueous ammonia would be used as a reagent in the proposed process, and thousands of pounds of either chemical could be stored onsite. Ammonia processes that have a stored quantity of 10,000 pounds or more are regulated under the OSHA Process Safety Management Standard (PSMS) (29 CFR 1910.119) and the EPA RMP (40 CFR 68) regulations. Two components of the project would exceed this threshold, the refrigeration system and the CO_2 absorption process.

Anhydrous Ammonia. Ammonia (NH_3) is a compound consisting of three molecules of hydrogen and one molecule of nitrogen. In a diluted form, ammonia is often used in commercial and household cleaning products. Anhydrous ammonia is a concentrated form of ammonia with the term anhydrous referring to the absence of water. Anhydrous ammonia is more commonly used in industrial applications.

The project would use anhydrous ammonia at a rate of 650 to 850 lbs/hr. Alternately, the project could use a 29-percent aqueous ammonia mixture as a reagent in place of anhydrous ammonia. Aqueous ammonia is a liquid at atmospheric conditions and is easier to handle and store than anhydrous ammonia. However, it would entail larger storage volumes, with similar environmental and safety controls, and operational issues for the CAP. Aqueous ammonia would be regulated under the EPA RMP rule, as aqueous ammonia at concentrations of 20 percent or greater is on the List of Regulated Toxic Substances and Threshold Quantities for Accidental Release Prevention in the RMP regulations (40 CFR 68.130). However, the 29-percent aqueous ammonia mixture would not be regulated under the process safety management requirements because the threshold for ammonia solutions on the OSHA PSMS list for highly hazardous chemicals is for solutions 44-percent ammonia or greater.

Delivery of ammonia would occur either by tanker truck or rail car, depending on vendor and distance. Anhydrous ammonia would likely be transported in an 18-ton insulated cargo tank truck for road transport, or in an 80-ton insulated tank car for rail transport. AEP estimates that approximately 180 truck shipments or 40 rail car shipments would be required each year for anhydrous ammonia delivery. If aqueous ammonia is chosen as the reagent, it would likely be transported in a 26-ton tank truck or in a 116-ton rail tank car. The delivery frequencies would increase to 430 truck shipments or 100 rail car shipments per year if aqueous ammonia is used. Potential storage volumes for these chemicals are presented in Table 2-2.

Potential impacts of ammonia releases on workers and the public would depend on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction), and other factors. Potential impacts of ammonia exposure are described under *Facility Accidents* in this section.

Carbon Dioxide

The project would capture and store underground approximately 1.65 million tons (1.5 million metric tons) of CO_2 per year. In addition to CO_2, the captured gas could contain other co-constituents including ammonia, oxygen, nitrogen, and water vapor. The CO_2 would be pressurized up to 3,000 psi and would be a supercritical fluid (i.e., exhibiting properties of both a liquid and a gas), ready for underground injection. If the CO_2 were released to the atmosphere, it would rapidly expand from a dense fluid to a gas, but could include both liquid and solid phases (i.e., dry-ice), as discussed in Appendix G. This means that leaks or releases of the supercritical liquid have the potential to result in high concentrations of CO_2 that can exceed CO_2 exposure limits and possibly reduce oxygen levels enough to cause asphyxiation in enclosed areas or in the immediate vicinity of the leak, if there was no air movement.

Health effects from CO_2 and co-constituents would be dependent on the concentration and length of exposure to each gas. Impacts of CO_2 releases on workers and the public would depend on the locations of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors. Potential release locations during the operational period would include the CO_2 storage facility, along the pipeline corridor, or at the injection wells. These potential releases and related impacts are described under *Facility Accidents* in this section. Releases from the subsurface storage formation after injection has stopped (e.g., from post-injection releases from improperly sealed deep wells, faults, and other types of leaks) are discussed separately later in this section,

Sulfuric Acid

The facility would store up to 45,000 gallons of sulfuric acid in an aboveground tank with secondary containment at atmospheric pressure. Sulfuric acid would be stored and used as a 93-percent aqueous solution, which has a minimal vapor pressure at ambient temperature. In other words, the aqueous solution of sulfuric acid would not evaporate readily and would not be expected to result in exposure concerns from resulting air concentrations or dispersion. As a result, accidental releases of this chemical would not be expected to be a concern for workers or offsite population exposure.

Ammonium Sulfate

Ammonium sulfate would be produced by the CAP as a by-product at the rate of approximately 2,500 lbs/hr. This material would be in a stable solid form that is soluble in water at about 41 percent. The material would present a low health hazard rating and is not flammable. Ammonia odors could be emitted if the material comes in contact with water, but these emissions are not considered to pose an exposure concern to onsite employees or off site receptors during transport and handling.

Normal Operations

As with the operation of any industrial facility, the potential for workplace hazards and accidents exists. To promote the safe and healthful operation of the project, AEP would employ qualified personnel and implement written safety procedures. These procedures would provide clear instructions for safely conducting activities involved in the initial startup, normal operations, temporary operations, normal shutdowns, emergency shutdowns, and subsequent restarts. The procedures for emergency shutdowns would include the conditions under which such shutdowns would be required and the assignment of emergency responsibilities to qualified operators to ensure that procedures are completed in a safe and timely manner. Also covered in the procedures would be the consequences of operational deviations and the steps required to correct or avoid such deviations. All employees working on or around the CCS system would be covered by a facility health and safety plan requiring training on the operating procedures and other requirements for safe operation of the project facilities. In addition, employees would receive annual refresher training, which would include the testing of their understanding of the procedures.

> Accident Categories and Frequency Ranges:
>
> Possible - Accidents estimated to occur one or more times in 100 years of facility operations (frequency ≥ 1 x 10^{-2}/yr).
>
> Unlikely - Accidents estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1 x 10^{-2}/yr to 1 x 10^{-4}/yr).
>
> Extremely Unlikely - Accidents estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1 x 10^{-4}/yr to 1 x 10^{-6}/yr).
>
> Incredible - Accidents estimated to occur less than one time in 1 million years of facility operations (frequency < 1 x 10^{-6}/yr).
>
> Health Effect Categories:
>
> Transient and reversible adverse effects - Headache, dizziness, sweating, vague feelings of discomfort.
>
> Irreversible adverse effects - Breathing difficulties, increased heart rate, convulsions, coma.
>
> Life-threatening effects

Approximately 38 employees would be required to operate the CO_2 capture facility with a projected 20 employees onsite at any given time. All workers would be appropriately trained to minimize adverse exposure consequences from a potential release. Workers would be exposed to hazards typical of an industrial setting and for the utility sector, and would include trip, slips, falls, as well as potential exposure to chemical or other industrial hazards. For the utility sector, the total incident rate per 100 employees in similar work situations is 3.5 with a day away/restricted or transfer rate of 1.9. When these rates are applied to the anticipated number of onsite employees, the projected number of recordable incidents per year is estimated to be 1.3, with 0.74 being lost time or restricted duty.

Workers could be exposed to low concentrations of certain chemicals (e.g., ammonia) through routine transfer and handling processes; however, these exposures would be expected to be within permissible limits. Small releases could exceed the STEL, and the only effective protective measures include sheltering in place or the use of a self-contained breathing apparatus (SCBA). Personal protective equipment would be located nearby, outside the areas where ammonia would be used and site personnel would be trained accordingly to respond to releases.

Potential health effects to the general public would not be expected during normal operations as it is not expected that the public would be exposed to chemical or industrial hazards, or contaminants that would exceed public health standards. As described in Section 3.1, Air Quality and Climate, emissions from the proposed facilities are not expected to result in the exceedance of air quality standards that are developed specifically to be protective of public health. Potential effects that could occur from the accidental release of chemicals or gases are described in the following section.

Facility Accidents

DOE reviewed the project for potential hazards and developed a range of accidents that could result in the release of hazardous chemicals and gases. The accidents considered include those that could occur during the handling, transfer, storage, and use of the various types of ammonia. In addition, DOE considered accidents that could occur from the compression, transport, injection, and storage of CO_2. The full range of potential CO_2 release scenarios are discussed in detail in Appendix G and are summarized in the pipeline and injection well discussion included in this section.

Each potential accident was carefully assessed to determine the potential frequency for which such an accident could occur. As described in Section 3.14.1.2, accidents were categorized as *possible*, *unlikely*, *extremely unlikely*, or *incredible* (see text box). When categorizing potential accidents, DOE considered engineering design and controls, as well as available industry safety statistics. DOE used this data to determine the potential frequency for each type of accident and release, as well as the potential for natural disasters or extreme events. For each accident considered, DOE evaluated the potential health effects to both workers and the public using three health effect categories: *transient and reversible adverse effects*, *irreversible adverse effects*, and *life-threatening effects* (see text box).

CO_2 Capture Facility Related Accidents and Consequences

DOE evaluated accident data included in the results of an EPA review of data in EPA's RMP database (see Section 3.14.2.6). Based on this report and the potential storage quantities for ammonia for the project, the potential frequency for an accident related to reagent storage would be 2.05 $x10^{-3}$ accidents per year for anhydrous ammonia, and 5.55 x 10^{-3} accidents per year for aqueous ammonia. Accident frequencies related to anhydrous ammonia refrigerant would be 3.5 x 10^{-3} accidents per year (based on the largest vessel quantity) and 1.12 x 10^{-2} accidents per year when considering the quantity of ammonia included in the entire closed loop refrigerant system. DOE also considered industry accident data compiled from offsite consequence analysis for ammonia use in selective catalytic reduction units (see Section 3.14.2.6). This data presented the following annual accident frequencies: $2.2x10^{-6}$ accidents per year for onsite truck release; 5.0 $x10^{-3}$ accidents per year for loading line failure; $9.5x10^{-5}$ accidents per year for storage tank failure; $5.3x10^{-4}$ accidents per year for process line failure; and $1.5x10^{-4}$ accidents per year for evaporator failure. Based on the data reviewed, DOE concluded that the annual frequencies for the ammonia-related accident events considered in this EIS, as described in the following sections, would fall in the "unlikely" range, or accidents that are estimated to occur between 100 and 10,000 years (i.e., $1x10^{-2}$ to $1x10^{-4}$ accidents per year).

Accidents and release scenarios that could occur from operation of the CO_2 capture facility are described in Table 3.14-7 and Table 3.14-8, respectively, for anhydrous and aqueous ammonia. Based on the data presented in Section 3.14.2.6, DOE considered the frequency range for all accident scenarios to fall into the "unlikely" category, or accidents that would have the potential to occur within 100 to 10,000 years. Probabilities of these accidents occurring under specific atmospheric conditions, could be lower and in the extremely unlikely range. Based on the frequency ranges and conservative approach to this analysis as described below, these accidents would not be expected to occur within the operational life of the project. Potential consequences from these accident scenarios are presented in Table 3.14-9 for anhydrous ammonia and in Table 3.14-10 for aqueous ammonia. These tables include the distance within which each ERPG concentration would be exceeded, as modeled using RMP guidance for worst case conditions, and for potential health effects that could occur for different wind directions under these conditions.

The end point distances presented in Table 3.14-9 and Table 3.14-10 represent the downwind atmospheric concentrations of vapor phase ammonia for the respective ERPG (see Table 3.14-11). ERPGs are widely used by many industries in gas dispersion consequence analyses to determine levels of exposure of workers and the public to vapors from toxic chemicals. As defined by the AIHA, ERPGs provide estimates for concentration ranges 'where a person may reasonably anticipate observing adverse effects as a consequence of exposure to the chemical in question.' Downwind atmospheric concentrations of volatilized (vapor-phase) ammonia were calculated using a wind speed of 3.4 miles per hour (1.5 m/sec) and a Pasquill atmospheric stability class F (most conservative) as inputs to EPA's DEGADIS model, which assumes a source duration of up to 1 hour.

Each scenario was evaluated for potential offsite receptor health effects using the EPA's DEGADIS model: worst-case releases during ammonia unloading from a rail car and truck, an anhydrous ammonia tank rupture (refrigerated and ambient temperature), and an aqueous ammonia tank rupture; and worst-case releases from a ruptured railcar and truck tanker during transportation. DEGADIS simulates the atmospheric dispersion of dense gas (or aerosol) clouds released at ground-level, with zero momentum into the atmospheric boundary layer and over flat, level terrain. The model describes the dispersion processes which accompany the ensuing gravity-driven flow and entrainment of the gas into the boundary layer.

Potential health effects that could occur from accidents are summarized in Table 3.14-9 for anhydrous ammonia and in Table 3.14-10 for aqueous ammonia. The range of effects includes all the effect categories, and are generally more severe with anhydrous ammonia-related accidents and with increased quantities of this chemical. In addition, wind direction was considered when estimating the number of individuals potentially affected by a particular release scenario. The predominant wind direction, from the southwest, was more favorable as downwind population density for this wind direction is lower. While less likely, east/southeast winds and northwest winds were less favorable as these winds would carry a release towards more populated areas. Potential effects for releases occurring with the predominant wind direction ranged from less than 2 to less than 13 individuals experiencing life-threatening effects, less than 2 to less than 13 individuals experiencing irreversible adverse effects, and less than 25 to less than 408 experiencing transient and reversible effects. Potential effects for worst-case wind direction (from the east/southeast) with a rupture of liquefied pressure anhydrous ammonia tank predicted less than 11 life-threatening effects, less than 153 irreversible effects, and less than 2,858 transient and reversible effects. The results for each specific scenario are further discussed in the remainder of this section.

Anhydrous Ammonia Scenarios

This section provides a detailed description of the release scenarios that were evaluated for anhydrous ammonia and summarized in Table 3.14-7.

Table 3.14-7. Worst Case Anhydrous Ammonia Accident and Release Scenarios

Accident/Release Scenario[a,b]	Description
Anhydrous Ammonia Storage Tank Rupture (250,000 pounds, refrigerated)[c,d]	**Unlikely:** The rupture of a refrigerated liquefied anhydrous ammonia tank is considered an unlikely event. Under this scenario, an anhydrous ammonia tank is assumed to be surrounded by a 3 foot high berm within a 2,500 square foot area. Rupture of the ammonia tank would release 250,000 pounds of anhydrous ammonia solution, creating a pool of anhydrous ammonia 28.1 inches deep, with a surface area of 2,500 square feet. The refrigerated anhydrous ammonia was assumed to be stored at its boiling point (-28°F, -33.3°C) at atmospheric pressure. Concentrations within 2.25 miles of the pool would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).
Anhydrous Ammonia Storage Tank Rupture (250,000 pounds, ambient temperature)[e]	**Unlikely:** The rupture of an ambient temperature, liquefied, under pressure anhydrous ammonia tank is considered an unlikely event. The anhydrous ammonia tank is assumed to be surrounded by a 3 foot high berm within a 2,500 square foot area. For a rupture of a tank containing 250,000 lbs. of pressurized anhydrous ammonia at ambient temperature (worst case 104°F), it is assumed that any liquid remaining after expansion to atmospheric pressure would be entrained in the vapor phase and would eventually evaporate before forming a liquid pool. Concentrations within 3.69 miles of the ruptured tank would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).
18-Ton Tank Truck (Anhydrous Ammonia)[e,f]	**Unlikely:** The accidental total release of anhydrous ammonia during unloading of an 18-ton tank truck is considered an unlikely event. For an undiked total release of pressurized anhydrous ammonia at ambient temperature (worst case 104°F), it is assumed that any liquid remaining after expansion to atmospheric pressure would be entrained in the vapor phase and eventually evaporate before forming a liquid pool. Concentrations within 1.52 miles of the pool would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).
80-Ton Rail Car (Anhydrous Ammonia)[e,f]	**Unlikely:** The accidental total release of anhydrous ammonia during unloading of an 80-ton rail car is considered an unlikely event. For an undiked total release of pressurized anhydrous ammonia at ambient temperature (worst case 104°F), it is assumed that any liquid remaining after expansion to atmospheric pressure would be entrained in the vapor phase and eventually evaporate before forming a liquid pool. Concentrations within 2.98 miles of the pool would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).

[a] "Worst Case" term adopted from RMP Guidance (40 CFR 68) to represent maximum potential and more likely (project lifetime cases).

[b] 10 minutes is default value from RMP Guidance for "Worst Case" releases. Assumed weather conditions: 104°F, 1.5 m/s wind, F-stability.

[c] Anhydrous ammonia stored at its boiling point under atmospheric pressure.

[d] Assumes tank surrounded by berm 3 feet high and 2,500 square feet area, which would contain 128 percent of liquid volume.

[e] Assumes tank contents at 104°F at its vapor pressure.

[f] Assumes basic mitigation measures would be employed before 50 percent of tank volume is released.

°C = degrees Celsius; ERPG = Emergency Response Planning Guidelines; °F = degrees Fahrenheit; lbs = pounds; ppmv = parts per million by volume

Table 3.14-8. Worst Case Aqueous Ammonia Accident and Release Scenarios

Accident/Release Scenario[a,b]	Description
29-percent Aqueous Ammonia Tank Rupture[f] (400,000 pounds, 104°F)	**Unlikely:** The rupture of an aqueous ammonia tank is considered an unlikely event. The aqueous ammonia tank is assumed to be surrounded by a 3 foot high berm within a 3,000 square foot area. For a rupture of a tank containing 400,000 lbs of 29-percent aqueous ammonia at ambient temperature (worst case 104°F), it is assumed that with a total vapor pressure of 21.53 psia, 7,465 pounds of the aqueous ammonia would be immediately vaporized. The remaining liquid (392,535 pounds) would be cooled to 90.2°F (due to the heat of vaporization), and have a density of 55.66 lbs/ft^3 and a volume of 7,052 ft^3 resulting in a liquid pool of 28.2 inches with a surface area of 3,000 feet. Concentrations within 2.26 miles of the ruptured tank would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).
26-Ton Tank Truck[f] (29-percent Aqueous Ammonia)	**Unlikely:** The accidental total release of aqueous ammonia during unloading of a 26-ton tank truck is considered an unlikely event. An undiked total release from the aqueous ammonia rail car would create a pool of aqueous ammonia of 1 cm depth, with an initial surface area of 2,696 square feet. Concentrations within 1.95 miles of the pool would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).
116-Ton Rail Car[c,d,e] (29-percent Aqueous Ammonia)	**Unlikely:** The accidental total release of aqueous ammonia during unloading of a 116-ton rail car is considered an unlikely event. An undiked total release from the aqueous ammonia rail car would create a pool of aqueous ammonia of 1 cm depth, with an initial surface area of 124,665 square feet. Concentrations within 4.25 miles of the pool would exceed ERPG Level 1 criteria for temporary health effects (25 ppmv – 1 hour) (see Table 3.14-11).

[a] "Worst Case" term adopted from RMP Guidance (40 CFR 68) to represent maximum potential and more likely (project lifetime cases).

[b] 10 minutes is default value from RMP Guidance for "Worst Case" releases. Assumed weather conditions: 104°F, 1.5 m/s wind, F-stability.

[c] Assumes same liquid volume as for corresponding anhydrous ammonia case. Mass adjusted for higher density of aqueous ammonia.

[d] Assumes tank contents at 104°F at its vapor pressure.

[f] Assumes tank surrounded by berm 3 feet high and 3,000 square feet area, which would contain 126 percent of liquid volume.

cm = centimeter; ERPG = Emergency Response Planning Guidelines; °F = degrees Fahrenheit; ft^3 = cubic feet; lbs = pound; ppmv = parts per million by volume; psia = pounds-force per square inch absolute

Table 3.14-9. Potential Health Effects from Unlikely Accidental Release of Anhydrous Ammonia

Accident	Predominant W/SSW Wind Direction (most likely condition)		E/SE Wind Direction (less likely condition)		NW Wind Direction (least likely condition)	
Rupture of Refrigerated Anhydrous Ammonia Tank	Rupture of refrigerated anhydrous ammonia tank could result in release of 250,000 pounds of anhydrous ammonia and expose human populations to gas containing high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 2.25 miles	Transient and reversible	<187	Transient and reversible	<1,765	Transient and reversible	<704
ERPG-2: 0.87 mile	Irreversible adverse	<7	Irreversible adverse	<6	Irreversible adverse	<6
ERPG-3: 0.36 mile	Life-threatening	<4	Life-threatening	<3	Life-threatening	<3
Rupture of Liquefied Pressure Anhydrous Ammonia Tank	Rupture of liquefied pressure anhydrous ammonia tank could result in release of 250,000 pounds of anhydrous ammonia and expose human populations to gas containing high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 3.69 miles	Transient and reversible	<408	Transient and reversible	<2,858	Transient and reversible	<828
ERPG-2: 1.35 miles	Irreversible adverse	<13	Irreversible adverse	<153	Irreversible adverse	<10
ERPG-3: 0.67 mile	Life-threatening	<13	Life-threatening	<11	Life-threatening	<11
Unloading of 80-Ton Rail Car with Anhydrous Ammonia	The release of anhydrous ammonia during unloading of an 80-ton rail car could result in exposure of human populations to high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 2.98 miles	Transient and reversible	<161	Transient and reversible	<2,410	Transient and reversible	<857
ERPG-2: 1.09 miles	Irreversible adverse	<8	Irreversible adverse	<7	Irreversible adverse	<7
ERPG-3: 0.55 mile	Life-threatening	<9	Life-threatening	<7	Life-threatening	<7
Unloading of 18-Ton Rail Car with Anhydrous Ammonia	The release of anhydrous ammonia during unloading of an 18-ton tank truck could result in exposure of human populations to high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 1.52 miles	Transient and reversible	<27	Transient and reversible	<312	Transient and reversible	<223
ERPG-2: 0.55 mile	Irreversible adverse	<2	Irreversible adverse	<2	Irreversible adverse	<2
ERPG-3: 0.28 mile	Life-threatening	<2	Life-threatening	<2	Life-threatening	<2

Note: Accident estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr).
E = east; NW = northwest; SE = southeast; SSW = south, southwest; W = west; ERPG = Emergency Response Planning Guidelines; NH_3 = ammonia

Table 3.14-10. Potential Health Effects from Unlikely Accidental Release of Aqueous Ammonia

Accident	Predominant W/SSW Wind Direction (most likely condition)		E/SE Wind Direction (less likely condition)		NW Wind Direction (least likely condition)	
Rupture of 29-percent Aqueous Ammonia Tank	Rupture of aqueous ammonia tank could result in release of 400,000 pounds of aqueous ammonia, and expose human populations to gas containing high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 2.26 miles	Transient and reversible	<25	Transient and reversible	<634	Transient and reversible	<659
ERPG-2: 0.88 mile	Irreversible adverse	<2	Irreversible adverse	<2	Irreversible adverse	<2
ERPG-3: 0.45 mile	Life-threatening	<3	Life-threatening	<2	Life-threatening	<2
Unloading of 116-Ton Rail Car with 29-percent Aqueous Ammonia.	The release of aqueous ammonia during unloading of a 116-ton rail car could result in exposure of human populations to high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 4.25 miles	Transient and reversible	<224	Transient and reversible	<2,576	Transient and reversible	<857
ERPG-2: 1.67 miles	Irreversible adverse	<11	Irreversible adverse	<133	Irreversible adverse	<95
ERPG-3: 0.73 mile	Life-threatening	<7	Life-threatening	<6	Life-threatening	<6
Unloading of 26-Ton Rail Car with 29-percent Aqueous Ammonia)	The release of aqueous ammonia during unloading of a 26-ton tank truck could result in exposure of human populations to high concentrations of NH_3. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.					
End Point Distances:	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**	**Type of Effect**	**No. Individuals**
ERPG-1: 1.95 miles	Transient and reversible	<31	Transient and reversible	<789	Transient and reversible	<641
ERPG-2: 0.78 mile	Irreversible adverse	<2	Irreversible adverse	<2	Irreversible adverse	<2
ERPG-3: 0.37 mile	Life-threatening	<2	Life-threatening	<1	Life-threatening	<1

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

E = east; NW = northwest; SE = southeast; SSW = south, southwest; W = west; ERPG = Emergency Response Planning Guidelines; NH_3 = ammonia

Table 3.14-11 Description of Hazard Endpoints for Ammonia Spill Receptors

Hazard Endpoint	Concentration (ppm)	Description
ERPG-1	25	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.
ERPG-2	150	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.
ERPG-3	750	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

ERPG = Emergency Response Planning Guidelines; ppm = parts per million

Rupture of a refrigerated anhydrous ammonia tank - Individuals exposed within a distance of 0.87 mile of the pool would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.36 mile of the spill. As a result, only workers (assumed to be within approximately 820 feet of a release) could potentially be exposed to life-threatening levels of atmospherically-dispersed anhydrous ammonia. However, members of the public at a further distance from the facility (see above) may also be potentially exposed to concentrations causing irreversible effects and/or transient reversible effects. Based on the analysis presented in Table 3.14-9, under predominant wind conditions less than 4 individuals would experience life-threatening effects, less than 7 would experience irreversible adverse effects, and less than 187 would experience transient and reversible effects.

Rupture of a liquefied pressure anhydrous ammonia tank - Individuals exposed within a downwind distance of 1.35 miles of the ruptured tank would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.67 mile of the spill. As a result, workers (assumed to be within approximately 820 feet of a release) and possibly nearby residents could potentially be exposed to life-threatening levels of atmospherically-dispersed ammonia. Members of the public at a further distance from the facility may also be potentially exposed to concentrations causing irreversible effects and/or adverse effects. The nearest residents are located approximately 0.5 mile (2,500 feet) east of the Mountaineer Plant.

Release of anhydrous ammonia during unloading of an 80-ton rail car - Individuals exposed within a distance of 1.09 miles of the pool would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.55 mile of the spill. Thus, workers (assumed to be within approximately 820 feet of a release) and possibly nearby residents could potentially be exposed to life-threatening levels of atmospherically-dispersed anhydrous ammonia. Members of the public at a further distance from the release may also be potentially exposed to concentrations causing irreversible effects and/or transient and reversible effects. The nearest residents are located approximately 0.5 mile (2,500 feet) east of the Mountaineer Plant.

Release of anhydrous ammonia during unloading of an 18-ton tank truck - Individuals exposed within a distance of 0.55 mile of the pool would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.28 mile of the spill. As a result, workers (assumed to be within approximately 820 feet of a release) could potentially be exposed to life-threatening levels of atmospherically-dispersed anhydrous ammonia. However, members of the public at a further distance from the facility may also be potentially exposed to concentrations causing irreversible effects and/or transient and reversible effects.

Aqueous Ammonia Scenarios

This section provides a detailed description of the release scenarios that were evaluated for aqueous ammonia and summarized in Table 3.14-8.

Rupture of a 29-percent aqueous ammonia tank - Individuals exposed within a distance of 0.88 mile of the ruptured tank would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.45 mile of the spill. Thus, workers (assumed to be within approximately 820 feet of a release) could potentially be exposed to life-threatening levels of atmospherically-dispersed ammonia. Members of the public at a further distance from the facility may also be potentially exposed to concentrations causing irreversible effects and/or transient and reversible effects.

Release of aqueous ammonia during unloading of an 116-ton rail car - Individuals exposed within a distance of 1.67 miles of the pool would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.73 mile of the spill. Thus, workers (assumed to be within approximately 820 feet of a release) possibly nearby residents could potentially be exposed to life-threatening levels of atmospherically-dispersed ammonia. Members of the public at a further distance from the facility may also be potentially exposed to concentrations causing irreversible effects and/or transient and reversible effects. The nearest residents are located approximately 0.5 mile (2,500 feet) east of the Mountaineer Plant.

Release of aqueous ammonia during unloading of an 26-ton tank truck - Individuals exposed within a distance of 0.78 mile of the pool would be expected to experience ammonia concentrations above ERPG Level 2 for irreversible adverse effects (150 ppmv – 1 hour), while life-threatening exposures (ERPG Level 3, i.e., 750 ppmv – 1 hour) could occur within 0.39 mile of the spill. Thus, only workers (assumed to be within approximately 820 feet of a release) could potentially be exposed to life-threatening levels of atmospherically-dispersed ammonia. However, members of the public at a further distance from the facility may also be potentially exposed to concentrations causing irreversible effects and/or transient and reversible effects.

CO_2 Capture Facility Related Accidents and Consequences Summary

Potential impacts of ammonia releases from the CO_2 capture facility on workers and the public would depend on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors. Based on the low probabilities of wind directions toward population centers, and the unlikely to extremely unlikely potential for releases from the facility, it is considered to be extremely unlikely that a release would occur under wind conditions that would be towards the population centers.

The probability of an accident during the transportation of ammonia either by rail car or tank truck is assumed to be similar to that during unloading. The impact distances discussed above would be the same, as the respective distances for the spill from the rupture of a rail car during a derailment or the rupture of a tanker truck due to a collision would be an undiked spill. The impact to the public may range from negligible to significant depending on how close a potential accident could occur to nearby population centers.

Sensitive Receptors

Persons with pre-existing asthma or other respiratory problems, including cardiopulmonary disease, are likely to be more sensitive to the adverse effects of ammonia. These individuals may experience airway constriction at relatively low concentrations (OEHHA, 1999). Persons taking high doses of aspirin, and persons receiving therapy with valproic acid (i.e., Depakote), essential amino acids, or hyperalimentation may have elevated blood ammonia levels (HSDB, 2010; OEHHA, 1999). Similarly, individuals with severe liver disease frequently have elevated levels of ammonia in their blood and cerebrospinal fluid. Theoretically, all these conditions could enhance the sensitivity of these individuals to systemically-absorbed ammonia. However, the effects of ammonia are primarily due to its direct corrosive action, and systemic toxicity is rarely observed. Therefore, except in cases of severe exposure where systemic absorption has occurred, enhancement of the toxicity of ammonia by the conditions listed above would be unlikely.

Eye contact with liquid ammonia or ammonia vapor may produce more serious effects in persons with corneal disease or glaucoma (HSDB, 2010).

Children may inhale relatively larger doses of ammonia due to their greater lung surface area to body weight ratio and increased minute volumes to weight ratio. Children could also receive higher doses due to their short stature and the higher levels of ammonia vapor that may be present near the ground (ATSDR, 2010).

Amine-Based Capture System Feasibility Study

An amine-based capture technology would require the use and storage of an aqueous amine solution. In addition, the amine-based capture system would generate a hazardous waste stream consisting of water, amines, and degradation products. Amines are typically caustic, corrosive, and smell similar to ammonia. Quantities of amine-based process chemicals and wastes stored onsite could present potential risks to human health from accidents or intentional destructive acts that release hazardous materials. Emissions of amines to the atmosphere would result from the operation of an amine-based CO_2 capture system. The low concentrations of amine emissions that would result would not be expected to result in adverse impacts to human health (Bellona, 2009). The feasibility study would evaluate this issue in more detail.

CO_2 Transport, Injection and Storage

The processed CO_2 would be transported via pipelines to the injection wells. The pipelines would be similar to other pipelines common in West Virginia and would be designed to handle CO_2, tested, and operated in accordance with all applicable federal and state regulations. AEP would comply with DOT standard pipeline protection and safety measures (49 CFR 195) to minimize pipeline CO_2 failures, including

- internal pipeline inspection methods using smart pigs to detect corrosion, pitting, or other pipe imperfections;
- frequent visual inspection and aerial surveys along pipeline ROWs to identify signs of damage or encroachment by vegetation or structures;
- a public awareness program to inform people how to identify the locations of pipelines and who to notify before conducting excavation work or digging, especially near the pipeline ROW; and
- training of pipeline operator staff on emergency and maintenance procedures.

The transported gases are expected to be greater than 99.5 percent CO_2, with other compounds that could be present in the pipeline as shown in Table 3.14-12. The trace gas of interest from a health perspective is ammonia, because the concentrations of this compound could be high compared to relevant health-related criteria. Under normal conditions, there may be trace amounts of ammonia in the captured gas; however, it is possible for the captured gas to contain up to 50 ppm of this compound. DOE assessed the potential pipeline release risks using the high concentration of ammonia and the expected CO_2 concentration shown in Table 3.14-12.

Table 3.14-12. Estimated Composition of Captured Gas

Compound	Quantity[a]
Carbon Dioxide	>99.5 vol%
Water	< 3,000 ppmv
Nitrogen	<100 ppmv
Ammonia	<50 ppmv

[a] Values for compounds were provided by AEP.
ppmv = parts per million by volume; vol% = percentage by volume

Two accidental release scenarios (pipeline rupture and puncture) represent the most likely causes of pipeline releases at larger volumes. A pipeline rupture release could occur if the pipeline becomes completely severed, typically by heavy equipment during excavation activities. A rupture could also result from a longitudinal running pipe fracture or a seam-weld failure. In such a case, all the fluid between the two nearest control valve stations could be discharged from the severed pipeline within minutes.

A pipeline puncture release is defined here as a 3-inch by 1-inch hole that could be made by a tooth of an excavator. In such a case, all of the contents in the pipeline between the two nearest control valve stations would discharge into the atmosphere, but the release would occur over a period of several hours, as the opening is small relative to the total volume and the pressure declines as the fluid escapes.

Captured CO_2 would likely be transported as a supercritical fluid, such that its density resembles a liquid but it expands to fill space like a gas. When mixed with water, the CO_2 can form carbonic acid, which is highly corrosive. For this reason, the moisture content of the CO_2 would be maintained at a low level for the project, below 3,000 ppmv. When CO_2 is released from a pipe, it expands rapidly as a gas and can include both liquid and solid (i.e., dry ice) phases, depending on temperature and pressure. Supercritical CO_2 has a very low viscosity, but is denser than air. In the event of a release, the CO_2 would escape through an open orifice in the pipeline as a gas moving at the speed of sound, referred to as choked or critical flow (Bird et al., 2006). In the rupture scenario, the escaping gas from the pipeline is assumed to escape as a horizontal jet at ground level, which is typically the worst-case event for heavier-than-air gases (Hanna and Drivas, 1987).

Releases to the atmosphere represent the primary exposure pathway considered in the exposure analysis. The receptor groups likely to be exposed by releases from pipelines or aboveground equipment at the plant or injection well site are onsite workers and offsite populations. In addition to the toxic health effects of a release, which would be dependent on the exposure concentrations, workers near a ruptured or punctured pipeline or wellhead are likely to also be affected by the physical forces from the accident itself, including the release of gases at high flow rates and at very high speeds. Workers involved at the location of an accidental release would be potentially affected, possibly due to a combination of effects, such as physical trauma, asphyxiation (displacement of oxygen), or frostbite from the rapid expansion of CO_2 (e.g., 3,000 psi to 15 psi).

DOE used the SLAB model to simulate rupture and puncture releases for the pipelines. Because AEP is considering a variety of options for injection well sites and related pipeline routes, as discussed in Section 2.3.4, DOE reviewed in detail various scenarios to evaluate potential effects. This analysis is presented in Appendix G, with the upper and lower bounds of potential consequences being summarized in Table 3.14-13. This table also presents the results of analysis of potential releases from injection well failure and the unexpected release of CO_2 from the subsurface storage formation after injection has ceased. Each potential release event has been categorized by its potential frequency of occurrence, with effects quantified in terms of number of individuals that could experience each type of health effect. Accident frequencies ranged from unlikely for pipeline ruptures and punctures to extremely unlikely for injection well failures, and incredible for release of stored CO_2 from the subsurface. The upper bound for potential health effects would occur from a pipeline rupture along the Eastern Sporn pipeline corridor, resulting in less than five individuals experiencing transient and reversible effects, less than one individual experiencing irreversible and adverse effects, and less than one individual experiencing life-threatening effects.

Table 3.14-13. Potential Lower and Upper Bound Effects from CO_2 Releases from Pipelines, Injection Wells, and Subsurface Storage Formation

Events	Lower Bound	Upper Bound
Incredible: Events estimated to occur less than one time in 1 million years of facility operations (frequency < 1 x 10^{-6}/yr).		
CO_2 release due to leakage from catastrophic failure of caprock or through lateral migration.	CO_2 concentrations in ambient air for this hypothetical would be less than established health criteria, and no effects to the public would be expected.	CO_2 concentrations in ambient air for this hypothetical would be less than established health criteria, and no effects to the public would be expected.
Extremely Unlikely Events: Estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1 x 10^{-4}/yr to 1 x 10^{-6}/yr).		
CO_2 release from failure of an injection well during operation.	Release of gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, could expose individuals to potential health effects within 50 feet of wellhead. These effects are expected to be primarily limited to workers. Effects on non-involved workers would be transient effects from CO_2 if present within approximately 50 - 150 feet of wellhead at time of release. Potential effects to offsite receptors at the Borrow Area well from CO_2 would be: **Type of Effect — No. Individuals** Transient and reversible — 0 Irreversible adverse — 0 Life-threatening — 0	Release of gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, could expose populations to potential health effects within 50 feet of wellhead. These effects are expected to be primarily limited to workers. Effects on non-involved workers would be same as lower bound. Potential effects to offsite receptors from CO_2 would be: **Type of Effect — No. Individuals** Transient and reversible Borrow Area Route — 0 Eastern Sporn Routes — < 1 Jordan Routes — < 1 Western Sporn Routes — < 1 Irreversible adverse (all) — 0 Life-threatening (all) — 0

Table 3.14-13. Potential Lower and Upper Bound Effects from CO_2 Releases from Pipelines, Injection Wells, and Subsurface Storage Formation

Events	Lower Bound	Upper Bound
Unlikely: Events estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1 x 10^{-2}/yr to 1 x 10^{-4}/yr).		
CO_2 release from pipeline rupture during operation.	Rupture of pipeline could result in exposure of human populations to gas containing high concentrations of CO_2, and potential trace concentrations of ammonia. **Type of Effect — No. Individuals** Transient and reversible: < 1 Irreversible adverse: < 1 Life-threatening: < 1	Rupture of pipeline could result in exposure of human populations to gas containing high concentrations of CO_2, and potential trace concentrations of ammonia. **Type of Effect — No. Individuals** Transient and reversible Borrow Area Route: < 1 Eastern Sporn Routes: < 5 Jordan Routes: < 4 Western Sporn Route: < 3 Irreversible adverse All routes: < 1 Life-threatening All routes: < 1
CO_2 release pipeline puncture during operation.	The puncture of a pipeline would release gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, and could expose populations to potential health effects: **Type of Effect — No. Individuals** Transient and reversible: 0 Irreversible adverse: 0 Life-threatening: 0	The puncture of a pipeline would release gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, and could expose populations to potential health effects: **Type of Effect — No. Individuals** Transient and reversible All routes: < 1 Irreversible adverse All routes: < 1 Life-threatening All routes: < 1
Post injection CO_2 release due to leakage from; abandoned or undocumented deep wells; existing faults; unknown structural or stratigraphic connections.	Release of CO_2 through these mechanisms would not be expected to result in concentrations in ambient air in excess of established health criteria; no effects to the public would be expected.	Release of CO_2 through these mechanisms would not be expected to result in concentrations in ambient air in excess of established health criteria; no effects to the public would be expected.

CO_2 = carbon dioxide; NH_3 = ammonia; yr = year

Intentional Destructive Acts

As with any U.S. energy infrastructure, the project could potentially be the target of terrorist attacks or sabotage. DOE examined the potential environmental impacts from acts of terrorism or sabotage against the project facilities.

Although the likelihood of sabotage or terrorism cannot be quantified, because the probability of an attack is not known, the potential environmental effects of an attack can be estimated. Such effects may include localized impacts from releases of toxic substances from the facility, which would likely be similar to what would occur under an accident or natural disaster. To evaluate the potential impacts of sabotage or terrorism, DOE considered failure scenarios without specifically identifying the cause of failure. For example, potentially harmful chemicals could be released as a result of component failure or human error (or a combination of both), or from such external events as aircraft crashes, seismic events, or other natural events as high winds, tornadoes, floods, ice storms, other severe weather, and fires (both natural and human-caused). Likewise, for truck and rail tanks, releases can occur from accidents or component failure during transport or from human error during transfer to the storage tanks at the facility.

Potential release scenarios of toxic chemicals and related consequences presented for the CO_2 capture facility, pipelines, and injection well sites are considered to be representative of those that could be caused by intentional destructive acts. However, the frequency or likelihood of such events due to this cause cannot be quantified.

3.14.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no incrementally-increased risks to Human Health and Safety of the types described.

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3.15 UTILITIES

3.15.1 Introduction

This section identifies and describes public utility systems potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project to these resources and the ability of existing utility infrastructure to meet the needs of the project while continuing to meet the needs of other users.

3.15.1.1 Region of Influence

The ROI for utility systems includes the existing public utility infrastructure and facilities that would provide service to the project. Utility service at the project site is limited to water, wastewater, and electricity.

3.15.1.2 Method of Analysis

A comparative assessment was performed of the proposed utility needs of the project versus the existing infrastructure to determine whether the project would result in a demand on any of the existing utility systems that could not be met by existing capacity. Existing utility demand and available unused capacity from the entire service area were obtained from the local utility providers. AEP predicted the estimated utility consumption for the Proposed Action, which was compared to the existing utility demand. The analysis considered whether the predicted demand of the project would be greater than the available unused capacity. Other factors for assessing impacts are described in Section 3.15.1.3.

3.15.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to utility systems based on whether the Mountaineer CCS II Project would directly or indirectly

- increase the demand on capacity of public water or wastewater utilities;
- require extension of water mains involving offsite construction for connection with a public water source;
- require extension of sewer mains involving offsite construction for connection with a public wastewater system;
- impact electricity service in the ROI;
- impact the effectiveness of existing utility infrastructure; or
- affect the capacity and distribution of local and regional utility suppliers to meet the existing or anticipated demand.

3.15.2 Affected Environment

3.15.2.1 CO_2 Capture Facility

Potable Water

The NHWF provides potable water to the ROI, which is within the New Haven municipality. Rural areas that are not supplied by the public water supply system use drilled or dug wells and springs. According to the New Haven Municipal Water and Sewer Department, the NHWF services approximately 650 users within the municipality of New Haven. The NHWF pumps approximately 150,000 gpd to its service area and has an overall capacity to provide 432,000 gpd (Oldaker, 2010). Overall, the NHWF currently operates at approximately 35 percent of its total capacity and has approximately 282,000 gpd of additional capacity for public water supply.

Based on a monthly average of approximately 338,175 gallons, the existing Mountaineer Plant uses approximately 11,088 gpd of potable water supplied by the NHWF. Therefore, the existing Mountaineer Plant currently accounts for approximately 7 percent of the total demand on the NHWF potable water supply.

Percentage of NHWF Output Attributed to the Mountaineer Plant:

- Mountaineer Plant Daily Usage [11,088 gpd] ÷ NHWF Daily Output [150,000 gpd] = 0.07 = 7 percent

Potable water is used primarily at the Mountaineer Plant by personnel. The Plant currently employs 195 personnel. Based on the average daily potable water usage (11,088 gpd), each employee uses approximately 57 gpd of potable water.

Average Potable Water Consumption per Employee:

- Total Plant Usage [11,088 gpd] ÷ Number of Employees [195] = 57 gpd per employee

Process Water

Process water is supplied to the Mountaineer Plant from the existing river water loop via the Ohio River. This river water loop is not a public utility and is wholly owned and operated by AEP. The Mountaineer Plant consumes approximately 18.74 mgd of process water. Additional details on the river water loop, total withdrawal allowance, and corresponding permits are discussed in Section 3.6, Surface Water.

Wastewater

The Mountaineer Plant generates wastewater from both sanitary facilities and industrial processes. These wastewater streams are processed at two different facilities, as described below.

Sanitary wastewater is piped to the NHSWF for treatment. The NHSWF facility currently processes 150,000 gpd, with an overall capacity of 400,000 gpd (Oldaker, 2010). Overall, the NHSWF currently operates at approximately 38 percent of its total capacity with approximately 250,000 gpd of additional capacity for wastewater treatment. Based on a monthly generation of approximately 359,187 gallons, the Mountaineer Plant discharges an estimated 11,777 gpd of sanitary wastewater to the NHSWF. Therefore, the Mountaineer Plant currently accounts for approximately 8 percent of the total demand on the NHSWF wastewater treatment.

Percentage of NHSWF Influent Attributed to the Mountaineer Plant:

- Mountaineer Plant Daily Effluent [11,777 gpd] ÷ NHSWF Daily Influent [150,000 gpd] = 0.08 = 8 percent

The Mountaineer Plant generates sanitary wastewater from personnel activities and currently employs 195 personnel. Based on the Plant's average daily sanitary wastewater discharge, each employee generates approximately 60 gpd of sanitary wastewater.

Average Sanitary Wastewater per Employee:

- Total Plant Usage [11,777 gpd] ÷ Number of Employees [195] = 60 gpd per employee

Industrial wastewater is treated on the Mountaineer Plant site. The Mountaineer Plant generates approximately 17.3 mgd of wastewater from industrial processes. As discussed in Section 2.3.3.4, industrial wastewater is treated by an onsite WWTP prior to discharge into the Ohio River. This industrial WWTP is not a public utility and is wholly owned and operated by AEP. The treatment process generates 0.14 mgd of sludge, which is disposed of at AEP's Little Broad Run Landfill adjacent to the

Mountaineer Plant (refer to Section 3.13, Materials and Waste Management, for further information on sludge disposal and the landfill).

Electricity

The Mountaineer Plant generates its own electricity through an onsite generating unit (i.e., a nominally rated 1,300-MW pulverized coal-fired electric generating unit). The full-load auxiliary power demand for current Plant operations is approximately 96 MW. This generating unit is wholly-owned and operated by AEP.

3.15.2.2 Pipeline Corridors

The potential pipeline corridors do not currently contain the infrastructure for water supply, wastewater treatment, or electrical power.

3.15.2.3 Injection Well Sites

The potential injection well sites do not currently contain the infrastructure for water supply, wastewater treatment, or electrical power.

3.15.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to utility systems in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.15.1.3.

3.15.3.1 Construction Impacts

CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Construction of the entire project, including the proposed CO_2 capture facility, pipeline corridors, and injection well sites, is expected to last 32 months. Between 25 to 175 workers would be needed for the first 12 months, 200 to 800 workers for the second 12 months, and 50 to 375 workers for the final 8 months.

Potable Water

Potable water would be supplied from existing connections to the NHWF during construction. The calculations below estimate the total daily consumption for the duration of construction. The calculations are based on the current daily water usage of the Mountaineer Plant (see Section 3.15.2.1) and assume that all potable water needs for construction would be supplied from the Mountaineer Plant or other AEP facilities.

Estimated Potable Water Consumption for First 12 Months of Construction:

- Minimum: [25 workers × 57 gpd] = 1,500 gpd
- Maximum: [175 workers × 57 gpd] = 10,000 gpd
- Based on the unused capacity of the NHWF (282,000 gpd), this represents between 0.5 percent and 4 percent of the NHWF’s unused daily capacity (Oldaker, 2010).

Estimated Potable Water Consumption for Second 12 Months of Construction:

- Minimum: [200 workers × 57 gpd] = 11,400 gpd
- Maximum: [800 workers × 57 gpd] = 45,600 gpd
- This represents between 4 percent and 16 percent of the NHWF’s unused daily capacity.

Estimated Potable Water Consumption for Final 8 Months of Construction:

- Minimum: [50 workers × 57 gpd] = 2,900 gpd
- Maximum: [375 workers × 57 gpd] = 21,400 gpd
- This represents between 1 percent and 8 percent of the NHWF’s unused daily capacity.

During construction, the increased demand for potable water would use between 0.5 percent and 16 percent of the unused capacity of the NHWF depending on the number of construction personnel onsite. As such, impacts to potable water utilities are expected to be short-term and minor.

Process Water

Construction of the entire project would be expected to use approximately 2.5 million gallons of process water. Hydrotesting and system startup are expected to require an additional 600,000 gallons of demineralized water. Construction water needs, as well as water needs for hydrotesting and system startup, would be supplied by the Mountaineer Plant's existing river water loop and demineralized water system, respectively. As such, impacts to water utilities are expected to be negligible.

Wastewater

For the entire project, sanitary wastewater during construction would be handled through either the public utility or portable restrooms, estimated as follows: waste from between 50 to 100 personnel would be directed to the NHSWF, the remainder of the wastewater would be disposed of offsite through contracts with portable restroom providers. The portable units would be collected and hauled to sewage treatment facilities in the area by licensed waste transporters. As a worst-case scenario, it is assumed that the NHSWF would ultimately receive the wastewater from the portable restrooms. Therefore, it is assumed the NHSWF would receive all sanitary wastewater generated during construction of the project.

The calculations are based on the current daily wastewater effluent of the Mountaineer Plant (see Section 3.15.2.1).

Estimated Sanitary Wastewater for First 12 Months of Construction:

- Minimum: [25 workers × 60 gpd] = 1,500 gpd
- Maximum: [175 workers × 60 gpd] = 10,500 gpd
- Based on the unused daily capacity of the NHSWF (250,000 gpd), this represents between 0.6 percent and 4 percent of the NHSWF's unused capacity (Oldaker, 2010).

Estimated Sanitary Wastewater for Second 12 Months of Construction:

- Minimum: [200 workers × 60 gpd] = 12,000 gpd
- Maximum: [800 workers × 60 gpd] = 48,000 gpd
- This represents between 5 percent and 19 percent of the NHSWF's unused daily capacity.

Estimated Sanitary Wastewater for Final 8 Months of Construction:

- Minimum: [50 workers × 60 gpd] = 3,000 gpd
- Maximum: [375 workers × 60 gpd] = 22,500 gpd
- This represents between 1 percent and 9 percent of the NHSWF's unused daily capacity.

During construction, the increase wastewater generation would be between 0.6 percent and 19 percent of the unused capacity of the NHSWF depending on the number of construction personnel onsite. As such, impacts to potable water utilities are expected to be short term and minor. If sanitary wastewater collected in the restroom trailers is disposed of at other wastewater facilities (i.e., private septic system), the demand from construction of the project on the NHSWF would decrease.

Electricity

Electricity for construction of the CO_2 capture facility would be provided by the existing Mountaineer Plant or by portable generators if necessary. Impacts on offsite utility providers would be negligible.

CO_2 Capture Facility

Utility demands for construction of the CO_2 capture facility have been included in the above totals. As previously noted, impacts to utilities are expected to be short-term and minor.

Pipeline Corridors

Utility demands for the potential pipeline corridor construction have been included in the above totals. As previously noted, impacts to utilities (via demand during the construction period) are expected to be short-term and minor.

Coordination with potentially affected utility providers would occur throughout engineering, design, and construction phases of the project to ensure that no significant impacts to existing utilities occur. Prior to construction, AEP would determine and demarcate the location of existing utilities to ensure that the pipelines could be installed safely and to reduce the probability of equipment making contact with or damaging existing utilities. To the extent practicable, new pipelines would be located within existing transmission line corridors to minimize potential impacts. Therefore, potential impacts to existing utility infrastructure from construction of the pipeline are expected to be negligible.

Injection Well Sites

Utility demands for the potential injection well site construction have been included in the above totals. As previously noted, impacts to utilities (via demand during the construction period) are expected to be short-term and minor.

Electrical power needs for construction of the injection well sites would be supplied by portable generators; therefore, there would be no impact to offsite electrical utility providers.

Drilling the wells would require the use of air, fresh water, fresh water mud, and/or brine water depending on the type of drill rig used and the formation of the well. Brine would be supplied by a contracted brine water supplier. Brine water would be sourced from other local drilling activities and disposed of through a brine well; therefore, use of brine water would not affect local utilities or water sources.

The primary source of fresh water for drilling four to eight injection wells has not been determined and would depend on the location and the nearby available water sources. Potential sources include the ash pond, surface water sources (i.e., Ohio River), or the Mountaineer Plant water system. The volume of fresh water used during drilling would depend on the drill rig used. It is estimated that approximately 50,400 gallons of fresh water over a month period would be required for drilling each well based on the most likely drilling scenario. AEP estimates the average daily fresh water demand for drilling each well would be approximately 1,667 gpd and the maximum daily demand would be 3,000 gallons per well.

AEP has identified the ash pond as the most likely source of water for drilling. Using the ash pond or the Ohio River as the source of fresh water for drilling would have no effect on public utilities. However, the Mountaineer Plant has also been identified as a potential source of fresh water for drilling, and the plant receives its water from the NHWF. Therefore, any scenario that includes using the existing plant's water system for drilling would affect local utilities.

For the purpose of determining potential effects to public utilities and because additional details on drilling injection wells are not available at this time, this assessment evaluates the scenario in which all water would be supplied by the public utility.

In the unlikely event that the public utility supplies all fresh water needed for drilling injection wells, the increased water demand would be between 2 and 9 percent of the unused daily capacity of the NHWF. As such, impacts to potable water utilities are expected to be short-term and minor.

AEP would likely be required by WVDEP to install monitoring wells as part of their UIC permitting process (see Section 2.3.5.2). The quantity and location of the monitoring wells would be based on the UIC permitting process and the results of geologic characterization work. AEP anticipates the need for one to three monitoring wells per injection well or per co-located pair of injection wells. Potential impacts to utilities would be similar to those described for the construction of the injection wells.

Estimated Average Fresh Water Usage for Construction of the Injection Well Sites:

- Minimum: [4 wells x 1,667 gpd per well] = 6,668 gpd of water
- Maximum: [8 wells × 1,667 gpd per well] = 13,336 gpd of water
- Based on the unused capacity of the NHWF (282,000 gpd), this represents between 2 and 5 percent of the NHWF's unused capacity (Oldaker, 2010).

Estimated Maximum Fresh Water Usage for Construction of the Injection Well Sites:

- Minimum: [4 wells x 3,000 gpd per well] = 12,000 gpd of water
- Maximum: [8 wells × 3,000 gpd per well] = 24,000 gpd of water
- This represents between 4 and 9 percent of the NHWF's unused capacity (Oldaker, 2010).

3.15.3.2 Operational Impacts

CO_2 Capture Facility

Potable Water

Once operational, the daily potable water demand would be limited to the needs of a daily workforce of approximately 38 additional employees. Based on an estimated usage rate of 57 gpd per person of potable water for consumption and sanitary needs, daily demand would increase by approximately 2,200 gpd, which represents 0.8 percent of the unused treatment capacity of the NHWF. As such, impacts to potable water utilities are expected to be minor.

Estimated Potable Water Consumption for Operation:

- [38 workers × 57 gpd] = 2,200 gpd
- Based on the unused daily capacity of the NHWF (282,000 gpd), this represents 0.8 percent of the NHWF's unused capacity (Oldaker, 2010).

Process Water

The CAP facility would require an increase of approximately 1.9 mgd of process water. This would be supplied from the Mountaineer Plant's existing water loop and would not affect local utilities.

Industrial Wastewater

Approximately 18 gpm of off-spec ammonium sulfate solution (15-35 percent by weight) would be generated from the new CO_2 capture facility. Although ammonium sulfate is a by-product for agricultural use, it may require treatment as a waste during upset conditions or in the event that a market for the product no longer exists. A purge/blowdown stream would also be generated from the direct contact cooling system. This purge would be periodic and would vary based on operations, but could be on the order of approximately 80 gpm on a continuous basis. An absorber-building sump would be housed in the main process area to capture process spills, washdown, miscellaneous drains, etc. The quantity of wastewater periodically purged from this sump is not defined, as it would vary during operations and maintenance activities.

As described in Section 2.3.3.4, the current onsite WWTP may have sufficient capacity to handle additional process flow from the proposed CAP facility. However, should the existing system prove incapable of providing the necessary capacity, process water from the CO_2 capture facility would be treated by a proposed new industrial WWTP. This new facility would be designed to accommodate the additional volume of process water generated from the project. Industrial wastewater would be treated and discharged to surface water sources (i.e., Ohio River) in accordance with all permit conditions (see Section 3.6, Surface Water, for additional information on surface water impacts). The project's operational industrial wastewater needs would have no impact on the NHSWF or other public WWTPs.

Sanitary Wastewater

Based on an estimated generation rate of 60 gpd per person of sanitary wastewater, approximately 2,300 gpd of sanitary wastewater would be generated during operations of the project. This represents 0.9 percent of unused capacity at the NHSWF. As such, impacts to existing public sanitary wastewater utilities are expected to be minor.

Estimated Wastewater Generation for Operation:

- [38 workers × 60 gpd] = 2,300 gpd
- Based on the unused daily capacity of the NHSWF (250,000 gpd), this represents 0.9 percent of the NHSWF's unused capacity (Oldaker, 2010).

Electricity

The electrical demand for operation of the project would be approximately 50 MW**,** with an estimated peak demand of 80 MW. This demand would be in addition to the existing maximum 96 MW demand of the current Mountaineer Plant. Overall, this would result in a maximum peak parasitic electrical demand for plant operations of 176 MW. Electrical power would be generated at the existing Mountaineer Plant and provided to the CO_2 capture facility by an onsite unit capable of meeting this demand. No impacts to offsite public electric utility providers are anticipated.

Pipeline Corridors

The potential pipeline corridors would have no independent operational utility demands. As such, no impacts would occur from this project component.

Injection Well Sites

The potential injection well sites would have no independent operational demand for potable water, process water, or wastewater utilities. As such, no impacts to these utilities would occur from this project component.

Electricity would be required at the injection well sites to power lighting, well maintenance, and compression systems. Electrical power would be supplied by AEP from its existing distribution network. If electricity is provided by the Mountaineer Plant's onsite generating unit, impacts to public utilities would be negligible. If connection to public electrical utilities would occur, potential impacts are expected to be minor.

3.15.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to utilities.

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3.16 COMMUNITY SERVICES

3.16.1 Introduction

This section identifies and describes the community services potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects to the following community services: law enforcement, fire protection, emergency response, healthcare services, and the school system.

3.16.1.1 Region of Influence

The ROI for community services includes Mason County, West Virginia, where the project would be located, as well as the bordering counties. These include Cabell, Jackson, and Putnam Counties in West Virginia, along with Gallia and Meigs Counties in Ohio. The community services data discussed below are reported by county. For emergency services related to potential accidents, the ROI includes Mason County.

3.16.1.2 Method of Analysis

Any influx of capital (spending) or employment to a region, such as from a large construction project, would affect the existing demographic conditions and, proportionately, the community services within that region.

DOE evaluated the impacts to community services based on anticipated changes in demand for law enforcement, fire protection, emergency response, health care services, and schools. In many cases, the change in demand is directly related to increased population. Therefore, DOE reviewed census data in conjunction with the socioeconomic analysis to analyze how population trends could affect community services.

3.16.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts based on whether the Mountaineer CCS II Project would directly or indirectly

- impede effective access by law enforcement, fire protection, and emergency response services in the ROI;
- displace law enforcement and fire protection facilities or increase the demand on service capacities of local and regional law enforcement, fire protection, and emergency response agencies;
- displace medical facilities or increase demand for hospital beds and medical facilities beyond available capacity; or
- displace school facilities or increase enrollment in local school systems beyond available capacity.

3.16.2 Affected Environment

3.16.2.1 CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Law Enforcement

The Mason County Sheriff's Office, located in Point Pleasant, West Virginia, serves the area including and immediately surrounding the Mountaineer CCS II Project. A total of 16 enforcement officers are employed by the Mason County Sheriff's Department. Approximately 0.63 officers per 1,000 residents serve Mason County, as compared to the U.S. average of 2.3 police officers per 1,000 residents (Project

America, 2008). Therefore, the total number of officers per 1,000 residents in Mason County is lower than the national average. Although the current ratio of law enforcement officers within Mason County is below the U.S. average, crime rates within the county are below the U.S. average, which is an indication that local law enforcement is adequately staffed (Best Places, 2010).

The West Virginia portion of the ROI (i.e., Mason, Cabell, and Putnam Counties) is served by the

- Mason County Sheriff's Office, Mason Police Department, Point Pleasant Police Department, New Haven Police Department, and the West Virginia State Police – Troop 5 Mason County Detachment in Mason County;
- Cabell County Sheriff's Office, Huntington Police Department, Barboursville Police Department, and Milton Police Department, and the West Virginia State Police – Troop 5 Huntington Detachment in Cabell County; and the
- Putnam County Sheriff's Department, the Eleanor Police Department, Hurricane Police Department, Nitro Police Department, Poca Police Department, and the Winfield Town Police in Putnam County (USACOPS, 2010).

The Ohio portion of the ROI (i.e., Gallia and Meigs Counties) is served by the

- Gallia County Sheriff's Office, Cheshire Police Department, Gallipolis Police Department, and the Rio Grande Police Department in Gallia County; and the
- Meigs County Sherriff's Office, Middleport Police Department, Pomeroy Police Department, Racine Police Department, Rutland Police Department, and the Syracuse Police Department in Meigs County (USACOPS, 2010).

Fire Protection/Emergency Response

The New Haven Volunteer Fire Department and the Mason Volunteer Fire Department serve the existing Mountaineer Plant. The New Haven Volunteer Fire Department is staffed by 40 volunteer firefighters, 5 line officers, a fire chief, a captain, and a lieutenant (Duncan, 2010). The New Haven Volunteer Fire Department is equipped with 4 engines and a tanker. The New Haven Fire Department is approximately 2 miles from the Mountaineer Plant and response time is approximately 5 to 8 minutes. The Mason Volunteer Fire Department is staffed by 35 volunteer firefighters, 5 line officers, a fire chief, a captain, and a lieutenant. The Mason Volunteer Fire Department is equipped with 3 engines. The Mason Fire Department is approximately 7 miles from the Mountaineer Plant and response time is approximately 8 to 10 minutes.

The West Virginia portion of the ROI is served by 6 fire stations (Flatrock, Leon, Mason, New Haven, Point Pleasant, and Valley) in Mason County, 7 fire stations (Barboursville, Culloden, Huntington, Lesage, Milton, Ona, and Salt Rock) in Cabell County, and 7 fire stations (Bancroft, Buffalo, Hurricane, Poca, Red House, Scott Depot, and Winfield) in Putnam County (Fire Department Directory, 2010). The Ohio portion of the ROI is served by 7 fire stations (Bidwell, Crown City, Gallipolis, Patriot, Rio Grande, Thurman, and Vinton) in Gallia County and 12 fire stations (Albany, Chester, Langsville, Long Bottom, Middleport, Pomeroy, Racine, Reedsville, Rutland, Scipio, Syracuse, and Tuppers Plains) in Meigs County (Fire Department Directory, 2010).

Mason County Office of Emergency Management serves as an umbrella organization covering several agencies including Enhanced 911 (or E911), Emergency Medical Services, Local Emergency Planning Committee, and overall emergency management. The Mason Department of the Mason County Office of Emergency Management has an estimated response time of approximately 6 minutes to the Mountaineer Plant.

Healthcare Services

The ROI is served by Pleasant Valley Hospital in Mason County; Cabell-Huntington Hospital and Saint Mary's Hospital in Cabell County; Stonewall Jackson Memorial Hospital, in Jackson County; Putnam General Hospital in Putnam County; and Holzer Medical Center in Gallia County. Pleasant Valley Hospital in Point Pleasant, West Virginia, is a 201-bed facility (i.e., a 101-bed acute care facility and a 100-bed nursing and rehabilitation center), 3 medical equipment sites, and a wellness center. Cabell-Huntington Hospital is a 313-bed facility and Saint Mary's Hospital is a 440-bed facility, both located in Huntington, West Virginia. Teays Valley Hospital is a 68-bed facility located in Hurricane, West Virginia. Stonewall Jackson Memorial Hospital is a 70-bed facility located in Weston, West Virginia. Holzer Medical Center is a 266-bed general medical and surgical hospital located in Gallipolis, Ohio. Based on 2009 total population in the ROI, there are 5.2 beds per 1,000 people. This is above the Hill-Burton Act threshold of 4.5 beds per 1,000 people (see text box). As such, healthcare services are adequate within the ROI.

> The Hill-Burton Act of 1946 established the objective standard for the number of hospitals, beds, types of beds, and medical personnel needed for every 1,000 people. The Hill-Burton standard is 4.5 beds per 1,000 residents (E-Notes, 2009).

Local School System

Table 3.16-1 displays the number of public high schools, middle schools, and elementary schools within Mason, Cabell, Jackson, Putnam, Gallia, and Meigs Counties, as well as the average student-to-teacher ratios.

Table 3.16-1. School Statistics within the ROI

	Cabell	Mason	Jackson	Putnam	Meigs	Gallia
Number of Schools	30	11	13	23	10	11
Average Student-to-Teacher Ratio	14.2	12.9	14.1	14.1	18.0	17.8

Sources: Public School Review, 2010 and Ohio Department of Education, 2010
ROI = region of influence

3.16.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to community services in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.16.1.3.

3.16.3.1 Construction Impacts

CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Construction workers could be drawn from a large labor pool within the ROI; however, some temporary construction workers with specialized training, and workers employed by contractors from outside the ROI, would also likely be employed to construct the Mountaineer CCS II Project. During the first 12 months, construction personnel would range from 25 initially to 175 after 12 months. The second year, construction workers would range from 200 to 800 at peak construction. The remaining 8 months of construction would begin with approximately 375 workers and reduce to 50 near the end of construction. Most of these workers would be expected to commute to the construction site on a daily basis, while others would relocate to the area for the duration of the approximately 32-month construction period. Therefore, any population increase in the ROI due to construction would be temporary and negligible to minor.

Law Enforcement

Temporary construction jobs created by the Mountaineer CCS II Project could cause a slight increase in temporary residents within the ROI. The exact number of construction workers and their families who would temporarily relocate to the area for the project is unknown. However, sufficient numbers of workers are currently unemployed and living within the ROI and are available to support the project (see Section 3.17, Socioeconomics, for more information regarding population distribution and changes). Therefore, the number of workers relocating temporarily would be minimal. The increased temporary population could affect the short-term working capacities of individual local law enforcement agencies. Calls for service could increase due to the temporary increase in population. However, this impact would be temporary in nature. Existing law enforcement agencies should be adequately staffed to handle the temporary increase in population. Construction of the Mountaineer CCS II Project would not displace any law enforcement facilities, impact law enforcement access, or conflict with local and regional plans for law enforcement services. Therefore, potential impacts to law enforcement due to construction of the project would be negligible.

Fire Protection/Emergency Response

The six fire departments within Mason County are members of Mason County's mutual aid program and any of these fire departments would be available to assist in a fire emergency or hazardous release if needed (Blake, 2010). Meigs and Gallia Counties are also part of this mutual aid agreement. Construction of the Mountaineer CCS II Project would involve the use of flammable and combustible materials that could pose an increased risk of fire or explosion. However, the probability of a significant fire or explosion is very low, as described in Section 3.14, Human Health and Safety. The West Virginia and Ohio fire departments within the ROI have the capacity and are equipped to respond to a major fire emergency at the Mountaineer CCS II Project (Blake, 2010). Any incidents that may occur during construction of the Mountaineer CCS II Project would not increase the demand of fire protection services beyond the available capacity of currently existing services. The construction of the project would not displace any fire protection facilities, conflict with local and regional plans for fire protection services, or impede access for fire protection services. Thus, potential impacts to fire protection services due to construction of the project would be negligible.

Emergencies during construction of the project would not be expected to increase the demand for emergency services beyond current available capacity. As discussed above, the ROI is served by an abundance of emergency response staff and equipment throughout West Virginia and Ohio that could be available for local response within approximately 6 minutes of notification (for the Mason Department of the Mason County Office of Emergency Management). While it is not anticipated that emergency response conflicts would arise, the potential impacts to emergency services due to construction would be negligible.

Healthcare Services

The temporary construction jobs created by the Mountaineer CCS II Project could cause an increase of temporary residents within the ROI. Currently, the ROI has 5.3 hospital beds per 1,000 residents. The Hill-Burton Act standard is 4.5 hospital beds per 1,000 residents and the U.S. average as of 2007 was 2.7 hospital beds per 1,000 residents (Pearson, 2009). Even if all of the temporary construction workers relocated (i.e., up to 800 construction workers) within the ROI, the ratio of hospital beds per 1,000 residents would still remain at 5.3. This number is still in compliance with the Hill-Burton standard and well above the U.S. average. Therefore, potential impacts on healthcare services due to construction of the project would be negligible.

Local School System

Due to the temporary nature of the construction phase of the Mountaineer CCS II Project, it is unlikely that the construction workers would permanently relocate their families to the ROI. It is more likely that temporary workers who permanently reside outside of the ROI would seek short-term housing for themselves during the work week. As a result, potential impacts to local school systems due to construction would be negligible. In addition, the Mountaineer CCS II Project would not displace school facilities or conflict with local and regional plans for school system capacity or enrollment.

3.16.3.2 Operational Impacts

CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

The Mountaineer CCS II Project would increase the existing plant operating staff by approximately 38 full-time employees. Even if all of the staff relocated to the ROI, the increase in population would be very small. Based on the 2008 estimated population and the average family size within the ROI (2.5 people per household), the relocation of 38 employees could result in a population increase of 95 people, representing a 0.04 percent increase in population within the 6-county ROI. Therefore, any population increase in the ROI due to operations would be negligible to minor.

Law Enforcement

The anticipated 0.04 percent maximum increase in population in the ROI due to operations of the Mountaineer CCS II Project would have a negligible effect on the ratio of law enforcement officers per 1,000 residents. In addition, the average crime rate in the ROI, as discussed earlier, is well below the state and national averages, indicating that existing law enforcement services are appropriately staffed and would be sufficient to handle the anticipated long-term increase in population. Therefore, potential impacts to law enforcement due to operations would be negligible.

Fire Protection

As described in Section 3.16.3.1, the six fire departments within Mason County are members of the Mason County's mutual aid program and any of these fire departments would be available to assist in a fire emergency if needed (Blake, 2010). Operation of the Mountaineer CCS II Project would involve the use of flammable and combustible materials that pose an increased risk of fire or explosion at the project site; however, the probability of a significant fire or explosion is very low as described in Section 3.14, Human Health and Safety. Prior to operation of the Mountaineer CCS II Project, copies of the Material Safety Data Sheets (which provide the information needed to allow the safe handling of hazardous substances) for the process materials and chemicals to be stored and used would be provided to the local fire departments. The West Virginia and Ohio fire departments within the ROI have the capacity, and are equipped to respond to a major fire emergency at the site. Any incidents that may occur during operation of the Mountaineer CCS II Project would not increase the demand of fire protection services beyond the available capacity of currently existing services. Thus, the potential impact to fire protection services due to operations would be negligible.

Emergency and Disaster Response

Emergencies during operation of the project would not be expected to increase the demand for emergency services beyond current available capacity. As previously discussed in *Fire Protection/Emergency Response*, the ROI is served by an abundance of emergency staff throughout West Virginia and Ohio that could be available for local response within 6 minutes of notification (for the Mason Department of the Mason County Office of Emergency Management). Mutual aid agreements are in place between Mason, Meigs, and Gallia Counties (Duncan, 2010). The operation of the project would not displace any emergency response facilities, conflict with local and regional plans for emergency response services, or impede access for emergency response services. While it is not anticipated that emergency response conflicts would arise, the potential impacts to emergency services due to operations would be negligible.

Section 3.14, Human Health and Safety, describes the risks from operation of the Mountaineer CCS II Project, including the potential for intentionally destructive acts. The risks to the health and safety of the public are considered to be very low and the emergency response capabilities are expected to be adequate to address accidents and other risks.

Healthcare Services

Once operational, the Mountaineer CCS II Project would have a staff of approximately 38 full-time equivalent employees (i.e., permanent and contract employees). Based on the 2008 estimated population and the average family size (2.5 people per household), this increase would result in an increase in population of approximately 95 residents. Currently, healthcare capacity within the ROI is above the national average, with 5.3 hospital beds per 1,000 residents. Although the project would increase the number of residents possibly requiring medical care, the ratio of hospital beds per 1,000 residents would remain at approximately 5.3 and, therefore, no impacts are expected. Operation of the project would not displace any healthcare facilities or conflict with local and regional plans for healthcare or emergency services. Therefore, potential impacts on healthcare services due to operations would be negligible.

Local School System

Once operational, the Mountaineer CCS II Project would have a staff of approximately 38 full-time equivalent employees. Of these 38 employees, the actual number who would relocate to the ROI with their families to work at the Mountaineer CCS II Project is unknown. Based on the average number of children per family in West Virginia and Ohio (1.79 children), it can be estimated that a maximum of 68 new school-aged children could relocate to the ROI. If all 38 new employees relocated to the ROI, an additional 68 new school-aged children could require the addition of 4 teachers in order to maintain the average student-teacher ratio of 15/1. However, based on the unemployment rate and number of available school districts within the ROI, it is unlikely that all 38 full-time employees would relocate to the ROI, and certainly to the same district. Therefore, potential impacts to local school systems due to operations would be negligible.

3.16.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to community services.

3.17 SOCIOECONOMICS

3.17.1 Introduction

This section addresses the region's socioeconomic conditions potentially affected by the construction and operation of the Mountaineer CCS II Project. The discussion focuses on the region's demographics, economy, sales and tax revenues, per capita and household incomes, sources of income, housing availability. This section also analyzes the potential effects of this project to these resources.

3.17.1.1 Region of Influence

The ROI for socioeconomics includes Mason County, West Virginia, where the project would be located, as well as the five adjacent counties. These include Cabell, Putnam, and Jackson Counties in West Virginia, and Meigs and Gallia Counties in Ohio, across the Ohio River. DOE assumes for the purposes of this EIS that these counties would be most likely to experience socioeconomic impacts from the project. Given the existing high unemployment rates in the area, this EIS assumes that most of the additional employees needed to support the project would originate from and reside within the ROI.

3.17.1.2 Method of Analysis

DOE performed the socioeconomic impact analysis in this EIS in the following sequence: (1) DOE reviewed data from the U.S. Census Bureau to determine population and employment trends within the ROI; and (2) DOE overlaid the project, including community services and other impacts identified in other sections of this EIS, onto these existing trends to determine potential socioeconomic impacts. As discussed in Section 3.16, Community Services, the project would create new construction and operation jobs that may require the relocation of a very small number of workers to the ROI. Overall economic benefits would occur throughout the ROI.

3.17.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for socioeconomic impacts, both beneficial and adverse, based on whether the Mountaineer CCS II Project would directly or indirectly

- displace existing population or demolish existing housing;
- alter projected rates of population growth;
- affect the housing market to the point that demand would exceed capacity;
- displace existing businesses;
- affect local businesses and the economy;
- displace existing jobs; or
- affect local employment or the workforce.

3.17.2 Affected Environment

3.17.2.1 CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Population and Housing

The regional demographics for the ROI are provided in Table 3.17-1. In 2009, the total population for the counties within the ROI was approximately 258,054 (Census, 2010). The total population within the ROI increased slightly between 2000 and 2009 by an average of 0.5 percent over this period. This growth rate is roughly equivalent to that of West Virginia and slightly lower than Ohio over this same period. This rate is substantially lower than the average growth rate for the rest of the U.S.

Table 3.17-1. Population Distribution and Changes within the ROI

County	Year 2009 (estimate)				Population Change 2000 to 2009 (percent)
	Total	Under 18 (percent)[a]	65 and over (percent)[a]	Average Family Size[b]	
Mason (WV)	25,568	21.2	17.3	2.42	-1.5
Cabell (WV)	95,214	20.8	16.4	2.27	-1.6
Jackson (WV)	28,067	21.7	17.6	2.5	0.2
Putnam (WV)	55,673	23.0	13.5	2.56	7.9
Gallia (Ohio)	30,694	23.0	15.2	2.5	-1.2
Meigs (Ohio)	22,838	22.0	15.1	2.47	-1.0
Entire ROI	258,054	22.0	15.9	2.5	0.5
West Virginia	1,819,777	21.3	15.7	2.40	0.6
Ohio	11,542,645	23.5	13.9	2.49	1.7
United States	307,006,550	24.3	12.8	2.59	9.1

Source: Census, 2010
[a] 2008 Estimate.
[b] 2000 Value.
ROI = region of influence; WV = West Virginia

The 2009 estimated population of West Virginia was 1,819,777, which was a 0.6 percent increase from 2000 (Census, 2010). The 2009 estimated population of Ohio was 11,542,645, which was a 1.7 percent increase from 2000 (Census, 2010). The 2009 U.S. estimated population was 307,006,550, representing a 9.1 percent increase from 2000. The ROI population is anticipated to grow at a much slower rate than the U.S. and at a slower rate than the rest of West Virginia or Ohio. Mason County had a total population of 25,568 in 2009 (Census, 2010) with a rate of decline higher than the total ROI rate since 2000.

Approximately 24.3 percent of U.S. residents, 21.3 percent of West Virginia residents, and 23.5 percent of Ohio residents were under the age of 18 in 2008, versus an average of 22 percent within the ROI (Census, 2008). Approximately 12.8 percent of U.S. residents, 15.7 percent of West Virginia residents, and 13.9 percent of Ohio residents were over the age of 64 in 2008 versus 15.9 within the ROI (Census, 2008); therefore, a slightly older population is living within the ROI.

Table 3.17-2 provides total housing and vacant units by county within the ROI. As of 2008, there were 118,862 existing housing units within the ROI, with Mason County accounting for 12,429 (about 10.5 percent) of those units (Census, 2008). Of the existing housing units within the ROI in 2008, 14,419 (about 12 percent) were vacant (Census, 2008). Of the total vacant units, there were 10,816 units (about 75 percent) for rent (Census, 2008).

Economy and Employment

Table 3.17-3 provides information about the workforce, per capita incomes, and median household incomes for the counties within the ROI. In May 2010, the average unemployment rate for the ROI was 11.0 percent, compared to 9.5 percent in the U.S. (for June 2010) and 8.6 percent in West Virginia (WorkForce West Virginia, 2010). Thus, the unemployment rate within the ROI is higher than that for West Virginia and the U.S. Mason County's May 2010 unemployment rate of 13.4 percent was among the highest in the ROI (and Mason County's per capita and median household income was among the lowest) (see Table 3.17-3). Within the 6-county ROI, 7,974 workers were employed in the construction industry in 2008 (Census, 2008).

Table 3.17-2. Housing within the ROI

County	Total Housing Units (2008)	Vacant Units (2008)		
		Vacant Housing Units	Homeowner Vacancy Rate (percent)	Rental Vacancy Rate (percent)
Mason (WV)	12,429	1,699	2.1	4.0
Cabell (WV)	46,283	5,916	1.1	6.1
Jackson (WV)	12,636	1,539	0.6	8.2
Putnam (WV)	23,357	2,303	1.2	14.3
Gallia (Ohio)	13,329	1,485	0.8	12.5
Meigs (Ohio)	10,828	1,477	0.3	9.2
Total	**118,862**	**14,419**		
Average			**1.0**	**9.1**

Source: Census, 2008
ROI = region of influence; WV = West Virginia

Table 3.17-3. Employment and Income within the ROI

County	Employment[a]		Income[b]	
	May 2010 Labor Force (estimate)	May 2010 Unemployment Rate (percent)	2008 Per Capita Income (estimate)	2008 Median Household (estimate)
Mason (WV)	9,910	13.4	$14,804	$34,166
Cabell (WV)	43,870	7.7	$17,638	$33,360
Jackson (WV)	11,030	11.9	$16,205	$40,503
Putnam (WV)	27,010	7.4	$20,471	$57,255
Gallia (Ohio)	14,300[c]	10.5[c]	$15,183	$38,997
Meigs (Ohio)	9,900[c]	15.0[c]	$13,848	$33,683
Entire ROI	**116,020**	**11.0**	**$16,358**	**$39,660**
West Virginia	**788,300**	**8.6**	**$21,003**	**$48,001**
United States	**NA**	**9.5[c]**	**$21,587**	**$52,029**

[a] Source: Workforce West Virginia, 2010.
[b] Source: Census, 2008.
[c] June 2010 data.
NA = not applicable; ROI = region of influence; WV = West Virginia

In 2008, the average median household income for the entire ROI was $39,660 and the average per capita income was $16,358 (Census, 2008). In comparison, the median household income for the U.S. was $52,029 and the per capita income was $21,587 (Census, 2008). The State of West Virginia had a median household income of $48,001 and a per capita income of $21,003 (Census, 2008). Mason County had a median household income of $34,166 and a per capita income of $14,804 (Census, 2008). Based on 2008 Census data, both Mason County and the entire ROI have median household and per capita incomes that are less than both the West Virginia and U.S. averages.

This analysis identifies that, based on available data, the ROI (and especially Mason County) has a higher unemployment rate and lower income than surrounding areas and the U.S. as a whole.

Taxes and Revenue

In the State of West Virginia in Fiscal Year 2010, personal income tax collections were $110.6 million, or 7.1 percent below prior year receipts. Sales and use tax collections were $14.3 million, or 1.3 percent below prior year receipts. Severance tax collections were $5.5 million, or 1.3 percent above prior year receipts. Corporate net income/business franchise tax receipts were $47.4 million, or 16.6 percent below prior year receipts. Business and occupation tax collections were $16.9 million, or 11.2 percent below prior year collections. All other receipts were $5.0 million, or 1.1 percent below prior year collections.

Overall, these data identify a statewide reduction of economic performance and an increase in severance. Given current national economic conditions, these trends are consistent with the rest of the U.S.

3.17.3 Direct and Indirect Impacts of the Proposed Action

DOE assessed the potential for impacts to socioeconomics in the ROI based on whether the Mountaineer CCS II Project would result in any of the effects identified in Section 3.17.1.3.

3.17.3.1 Construction Impacts

Population and Housing

There would be a negligible to minor impact to population and housing from construction of the Mountaineer CCS II Project. To the extent impacts occur, they are expected to be short-term and generally beneficial to the ROI. The acquisition of land for construction of the project should not require the displacement of population or demolition of existing housing.

The need for construction workers would be limited to the estimated 32-month construction period. A potential increase of approximately 800 temporary employees within the ROI, or about 0.3 percent of the ROI’s population, is not expected to cause an appreciable increase in population or permanently alter population growth rates. Between 25 and 175 workers would be needed for the first 12 months, 200 to 800 workers for the second 12 months, and 50 to 375 workers for the final 8 months.

Within the 6-county ROI, 7,974 workers were employed in the construction industry in 2008 (Census, 2008). Based on the ROI’s average 11 percent unemployment rate in May 2010, roughly 875 potential construction workers can be reasonably presumed to be unemployed in the ROI. Therefore, it is anticipated that general construction workers would primarily come from the local workforce and already reside within the ROI. However, a smaller number of temporary construction workers with specialized training, and workers employed by contractors from outside the ROI, would also likely be employed to construct the project. Some of these workers would be expected to commute to the construction site on a daily basis, while others would relocate to the area for the duration of the construction period. Therefore, a negligible to minor, temporary increase in population may occur.

The minor temporary increase in population would increase local housing demand commensurately and would have a minor beneficial short-term impact on the ROI’s housing market. The ROI has approximately 14,419 vacant housing units for rent, with Mason County accounting for approximately 1,699 of these units. Thus, ample housing is available. Depending upon the percentage of construction jobs that would be filled by existing residents, the increase of employees from outside the ROI could increase the occupancy rate for vacant housing units and hotels within the ROI. This would result in a positive, direct impact for the rental and hotel industry within the ROI. Additionally, area residents may rent available rooms to supplement their household incomes, thereby contributing to a beneficial effect.

Economy and Employment

There would be a moderate, short-term, beneficial impact to economy and employment within the ROI from construction of the Mountaineer CCS II Project.

Construction of the Mountaineer CCS II Project would directly create up to 800 full-time and part-time construction jobs over the proposed 32-month duration of the construction project. These workers would be paid consistent with wages in the area for similar trades. Direct, short-term impacts to employment would occur from jobs related to construction. Indirect employment (e.g., restaurant staff) from incidental spending due to this increase in jobs may also be created in the ROI. Therefore, a moderate, short-term beneficial impact on employment rates and income would occur within the ROI during the construction period.

The purchase of building materials, construction supplies, and construction equipment, as well as spending by the construction workers, would add income to the economy. These expenditures commonly include gasoline, automobile servicing, food and beverages, laundry, and other retail purchases undertaken in the immediate area because of convenience and access during the course of the business day. Therefore, a short-term, beneficial impact to economic activity would occur during the construction period.

No existing businesses or jobs would be expected to be displaced.

Taxes and Revenue

There would be a moderate, short-term, beneficial impact to taxes and revenue within the ROI from construction of the Mountaineer CCS II Project.

Construction of the project would generate revenue through state and local taxes over the duration of the construction project. Local entities would benefit from temporarily increased sales tax revenues resulting from project-related spending on payroll and construction materials. It is anticipated that construction workers would spend their wages on short-term housing, food, and other personal items within the ROI. Additional sales tax revenues could result from taxes that are embedded in the price of consumer items such as gasoline. Therefore, an indirect and beneficial short-term impact could be expected for the local economy from increased spending and related sales tax revenue.

3.17.3.2 Operational Impacts

Population and Housing

There would be a negligible to minor impact to population and housing from operation of the Mountaineer CCS II Project.

The Mountaineer CCS II Project would increase the existing plant operating staff by approximately 38 full-time employees. During operation of the project, housing for workers relocating to the area would likely be distributed between owned and rental accommodations. Even if all of the staff relocated to the ROI, the increase in population would be very small. Based on the 2008 estimated population and the average family size (2.5 people per household) within the ROI, the relocation of 38 employees could result in a population increase of 95 people, representing a 0.04 percent increase in population within the 6-county ROI. Therefore, operation of the project would have a negligible to minor effect on regional population and housing.

Economy and Employment

There would be a minor, long-term, beneficial impact to economy and employment within the ROI from operation of the Mountaineer CCS II Project.

The operational phase of the project would have annual operation and maintenance needs that would benefit the ROI. Local contractors could be hired to complete specialized maintenance activities that could not be undertaken by permanent staff, and items such as repair materials, water, and chemicals could be purchased within the ROI. This would have a beneficial impact on the economy in the ROI.

The operational phase of the project would also have a direct and beneficial impact on employment by creating approximately 38 permanent jobs in the ROI. These new jobs would represent a 0.04 percent increase in the total number of workers employed in the ROI. Each new operations job created by the project would generate both indirect and induced jobs. An indirect job supplies goods and services directly to the project. An induced job results from the spending of additional income from indirect and direct employees. This would have a beneficial impact on the economy and employment in the ROI.

No existing businesses or jobs would be expected to be displaced.

Taxes and Revenue

There would be a negligible, long-term impact to taxes and revenue within the ROI from operation of the Mountaineer CCS II Project.

The estimated 38 employees who would fill new jobs created by the project could generate income tax revenues, as well as sales and use tax revenues within the ROI. This increase in revenue is anticipated to be negligible.

3.17.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no change to socioeconomic conditions.

3.18 ENVIRONMENTAL JUSTICE

3.18.1 Introduction

This section identifies low income and minority communities potentially affected by the construction and operation of the Mountaineer CCS II Project. This section also analyzes the potential effects of this project on low income and minority communities.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, provides that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (White House, 1994).

DOE (2009) defines "environmental justice" as:

> *The fair treatment and meaningful involvement of all people—regardless of race, ethnicity, and income or education level—in environmental decision making. Environmental Justice programs promote the protection of human health and the environment, empowerment via public participation, and the dissemination of relevant information to inform and educate affected communities. Department of Energy Environmental Justice programs are designed to build and sustain community capacity for meaningful participation for all stakeholders in Department of Energy host communities.*

In its guidance for the consideration of environmental justice under NEPA, the CEQ defines a "minority" as an individual who is American Indian or Alaskan Native, Black or African American, Asian, Native Hawaiian or Pacific Islander, Hispanic or Latino. CEQ characterizes a "minority population" as existing in an affected area where the percentage of defined minorities exceeds 50 percent of the population, or where the percentage of defined minorities in the affected area is meaningfully greater than the percentage of defined minorities in the general population or other appropriate unit of geographic analysis. The CEQ guidance further recommends that low-income populations in an affected area should be identified using data on income and poverty from the U.S. Census Bureau (CEQ, 1997a). Low-income populations are groups with an annual income below the poverty threshold, which was $22,025 for a family of four for calendar year 2008 (Census, 2008).

3.18.1.1 Region of Influence

The ROI for environmental justice includes lands within Mason County, West Virginia, in which the project would be located. DOE assumes for the purposes of this EIS that individuals within Mason County would represent the extent of the general population most likely to be affected by the project. DOE did not consider areas outside Mason County, in which the project is located, because any impacts extending beyond this area would impact the population equally and would not have a disproportionately adverse impact on low income or minority communities.

3.18.1.2 Method of Analysis

DOE performed the analysis for environmental justice in this EIS in the following sequence: (1) DOE collected demographic information from the U.S. Census Bureau to characterize low-income and minority populations within Mason County; (2) DOE used potential environmental, socioeconomic, and health impacts identified in other sections of this EIS to assess potential impacts to environmental justice that could occur as result of the proposed construction and operation of the project; and (3) DOE applied the CEQ's December 1997 Environmental Justice Guidance (CEQ, 1997a) that provides guidelines regarding whether human health effects on minority populations are disproportionately high and adverse. Under this guidance, federal agencies are advised to consider

- whether potential health effects, which may be measured in risks and rates, would be significant (as considered by NEPA), or above generally accepted norms;
- whether the potential risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard would be significant (as considered by NEPA) and appreciably exceed, or is likely to appreciably exceed, the risk or rate to the general population or other appropriate comparison group; and
- whether potential health effects would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple risks.

3.18.1.3 Factors Considered for Assessing Impacts

DOE assessed the potential for impacts to low income and minority populations based on whether the project would directly or indirectly

- cause a significant and disproportionately high and adverse effect on a minority population; or
- cause a significant and disproportionately high and adverse effect on a low-income population.

3.18.2 Affected Environment

3.18.2.1 CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites

Minority Populations

Table 3.18-1 compares the minority percentages and low-income percentages of Mason County with those of the State of West Virginia and the U.S. The majority of the population within Mason County is white (98.2 percent), as compared to the State of West Virginia (94.5 percent) and the U.S. (79.8 percent). The overall population in Mason County is roughly the same racially and ethnically (less than 5 percent non-white) as the general population of the state and far more homogeneous than the U.S.; therefore, a “minority population” as defined by CEQ does not exist in Mason County.

Table 3.18-1. County, State, and National Population and Low-Income Distributions (2008 Estimates)

Jurisdiction	Total Population (2009 Estimate)	White (percent)	Black (percent)	American Indian/ Alaska Native (percent)	Asian (percent)	Native Hawaiian/ Pacific Islander (percent)	Hispanic or Latino (all races) (percent)	Low-income (percent)
Mason County	25,568	98.2	0.7	0.2	0.3	<0.1	0.63	18.1
West Virginia	1,819,777	94.5	3.6	0.2	0.7	0.1	1.1	17.4
United States	307,006,550	79.8	12.8	1.0	4.5	0.2	15.4	13.2

Source: Census, 2008

Note: Some of the minority population counted themselves as more than one ethnic background, thus the counts do not add up to 100 percent.

Low-Income Populations

The percentage of low-income individuals within Mason County (18.1 percent) is generally comparable to the state (17.4 percent) and higher than the U.S. (13.2 percent) percentages (see Table 3.18-1). The percentage of low-income individuals living in Census Tract 954800, in which the project is located, is

16.9 percent. This is slightly lower than Mason County and the State as a whole, and slightly higher than the U.S. (Census, 2000).

3.18.3 Direct and Indirect Impacts of the Proposed Action

Based on the definitions and criteria outlined in Section 3.18.1, and the findings regarding environmental and socioeconomic impacts throughout this EIS, DOE performed the analysis for environmental justice in the following sequence:

- Using data from the 2008 American Community Survey and Census 2000, DOE determined the potential for adverse environmental or socioeconomic impacts resulting from proposed site-specific or corridor-specific project activities (construction or operation) to affect a minority or low-income population within the ROI and have a disproportionately high and adverse effect, as defined by CEQ and described in Section 3.18.1.
- Using the impacts analyzed in Section 3.14, Human Health and Safety, the potential for disproportionately high and adverse health risks to minority population and low-income populations was assessed.

3.18.3.1 Construction Impacts

<u>CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites</u>

As discussed in Section 3.18.2.1, there are no areas of minority population, as defined by EO 12898 and CEQ guidance, located within the ROI in Mason County. Therefore, no disproportionately high and adverse impacts to minority populations are anticipated.

As discussed in Section 3.18.2.1, Mason County has a slightly higher percentage of low-income individuals (18.1 percent) when compared to the state (17.2 percent) and the U.S. (13.2 percent). Census Tract 954800, in which the project is located, has a lower percentage of low-income individuals than both the remainder of Mason County and the State of West Virginia. Therefore, no disproportionately high and adverse impacts are anticipated to low-income populations. In addition, potential impacts to air quality, water quality, transportation, and noise (see Sections 3.1, Air Quality and Climate; 3.6, Surface Water; 3.11, Traffic and Transportation; and 3.12, Noise) associated with proposed construction would be temporary in nature. Conversely, short-term beneficial impacts may include an increase in employment opportunities and potentially higher wages or supplemental income through jobs created during construction (approximately 800 jobs) of the Mountaineer CCS II Project.

3.18.3.2 Operational Impacts

<u>CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites</u>

As discussed in Section 3.18.2.1, there are no areas of minority population located within the ROI. Therefore, no disproportionately high and adverse impacts to minority populations are anticipated.

Although there are low-income individuals living within the ROI, the percentage of low-income individuals living within Census Tract 954800 is lower than both the remainder of Mason County and the state. Therefore, no disproportionately high and adverse impacts to low-income populations are anticipated. In addition, a minor long-term beneficial impact to low-income populations would include an increase in employment opportunities and potentially higher wages or supplemental income through jobs created during operation (approximately 38 jobs) of the Mountaineer CCS II Project.

The potential health risks from a catastrophic accident, terrorism, or sabotage associated with the project are described in Section 3.14, Human Health and Safety. Census Tract 954800 (in which the Mountaineer CCS II Project is located) would be most at risk in the event of a release resulting from an accident or intentional destructive act. As described in Section 3.18.2.1, no minority or low-income populations exist in Census Tract 954800 at higher concentrations than in the general population of

Mason County. Therefore, no disproportionately high and adverse impacts to minority and low-income populations would be anticipated from an accident or intentional destructive act.

3.18.4 Direct and Indirect Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and there would be no environmental justice impacts.

4 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

4.1 COMPARATIVE IMPACTS OF ALTERNATIVES

As described in Section 2.4.1, the specific manner in which AEP would ultimately implement the Mountaineer CCS II Project is dependent upon a combination of factors. These factors include, but are not limited to, the results of the geologic characterization study, pipeline routing constraints, UIC permitting conditions, and various cost factors. To assess the potential range of impacts that could occur from implementation of the project, several scenarios have been considered in this EIS, as shown in Table 4.1-1. These scenarios present combinations of pipeline corridors and injection well sites/properties that are representative of a reasonable range of potential options that could be implemented. These are not intended to provide an exhaustive list of options, but rather to illustrate reasonable and plausible combinations, and to properly bound the impact analysis.

Table 4.1-1. Project Implementation Scenarios

Injection Well Property	Alternative Route	Scenario A "Lower Bound"	Scenario B	Scenario C "Upper Bound"
		Number of Injection Wells per Property		
Mountaineer Plant (MT-1 Location)	Plant Routing	2	0	0
Borrow Area	Borrow Area Route	2	2	2
Eastern Sporn Tract	Eastern Sporn Route 1	0	2	2
	Eastern Sporn Route 2			
	Eastern Sporn Route 3			
	Eastern Sporn Route 4			
Jordan Tract	Jordan Route 1	0	2	2
	Jordan Route 2			
	Jordan Route 3			
	Jordan Route 4			
Western Sporn Tract	Western Sporn Route	0	0	2

Assuming geologic characteristics are favorable at all locations, Scenario A would be AEP's preferred scenario and Scenario C would be AEP's least preferred scenario. This preference is based largely on cost, effort to implement, and environmental considerations. Scenario A would minimize these elements; Scenario C would maximize them. As such, Scenario C is the least preferable and considered to be the upper bound or "worst case" from an impact perspective because it would involve the greatest length of pipelines, the greatest number of required injection wells, and the greatest number of properties involved with the project. The number of injection wells on any one site would be based on the final design and could require more than two wells; however, AEP does not anticipate that the total number of wells required for the project would exceed eight (upper bound).

Table 4.1-2 summarizes the potential unavoidable impacts of the project for three project implementation scenarios in comparison to the No Action Alternative. The baseline conditions that are relevant to the No Action Alternative are described in Chapter 3 for each resource area. Potential impacts to each environmental resource area under the No Action Alternative and the Proposed Action are analyzed in depth in Chapter 3. The scenario impact analyses presented in Table 4.1-2 use the same characterizations for impacts as outlined in Section 3.0.2 as follows:

- ***Beneficial*** – Impact would improve or enhance the resource.
- ***Negligible*** – No apparent or measurable impacts are expected; may also be described as "none" if the resource is not present.
- ***Minor*** – The action would have a barely noticeable or measurable adverse impact on the resource.
- ***Moderate*** – The action would have a noticeable or measurable adverse impact on the resource. This category could include potentially significant impacts that would be reduced to a lesser degree by the implementation of mitigation measures.
- ***Substantial*** – The action would have obvious and extensive adverse effects that could result in potentially significant impacts on a resource despite mitigation measures.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	**Scenario A** ***(Lower Bound)*** *2 Wells at Mountaineer Plant* *2 Wells at Borrow Area*	**Scenario B** *2 Wells at Borrow Area* *2 Wells at Eastern Sporn Tract* *2 Wells at Jordan Tract*	**Scenario C** ***(Upper Bound)*** *2 Wells at Borrow Area* *2 Wells at Eastern Sporn Tract* *2 Wells at Jordan Tract* *2 Wells at Western Sporn Tract*
Air Quality and Climate			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to air quality.	**CONSTRUCTION** • *Minor.* Emissions of criteria pollutants would occur during the construction of the CO_2 capture facility, pipelines, and injection wells from the operation of vehicles, construction equipment, and land-disturbing activities. Impacts from these would be short term, localized, and minor.	**CONSTRUCTION** *Same as Scenario A.*	**CONSTRUCTION** *Same as Scenario A.*
	CO_2 Capture Facility • Estimated emissions include: Pollutant — tons (total) CO 32.7 NO_x 60.5 PM_{10} 69.4 $PM_{2.5}$ 10.6 SO_2 0.1 VOC 5.3	**CO_2 Capture Facility** *Same as Scenario A.*	**CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • Estimated emissions include: Pollutant — tons (total) CO 1.2 NO_x 2.9 PM_{10} 2.3 $PM_{2.5}$ 0.4 SO_2 0.01 VOC 0.3	**Pipeline Corridors** • Estimated emissions include: Pollutant — tons (total) CO 10.8 NO_x 26.4 PM_{10} 21.5 $PM_{2.5}$ 3.7 SO_2 0.1 VOC 2.3	**Pipeline Corridors** • Estimated emissions include: Pollutant — tons (total) CO 13.7 NO_x 33.7 PM_{10} 27.4 $PM_{2.5}$ 4.7 SO_2 0.1 VOC 2.9
	Injection Well Sites • Estimated emissions include: Pollutant — tons (total) CO 26.08 NO_x 65.2 PM_{10} 11.2 $PM_{2.5}$ 7.24 SO_2 0.12 VOC 4.72	**Injection Well Sites** • Estimated emissions include: Pollutant — tons (total) CO 39.1 NO_x 97.8 PM_{10} 16.8 $PM_{2.5}$ 10.9 SO_2 0.2 VOC 7.1	**Injection Well Sites** • Estimated emissions include: Pollutant — tons (total) CO 52.2 NO_x 130.4 PM_{10} 22.4 $PM_{2.5}$ 14.5 SO_2 0.2 VOC 9.4

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

<table>
<tr><th>No Action Alternative</th><th>Scenario A
(Lower Bound)</th><th>Scenario B</th><th>Scenario C
(Upper Bound)</th></tr>
<tr><td colspan="4">Air Quality and Climate (Cont'd)</td></tr>
<tr><td rowspan="2">CONSTRUCTION AND OPERATIONS
None. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to air quality.</td><td>OPERATIONS
CO_2 Capture Facility
• Beneficial. Overall emissions from the Mountaineer Plant, including SO_2, SO_3, and PM would be reduced through the operation of the CO_2 capture facility.
• Estimated increase (decrease) of emissions during operations would be:

Pollutant — tpy
NH_3 — 48.7
SO_2 — (1,886.6)
SO_3 — (623.2)
PM_{10} — (97)

• Minor. Ammonia concentrations in the flue gas could increase from 2 ppmv to approximately 3.3 ppmv; however, no regulatory standards would be exceeded. Increased ammonia concentrations could have the potential to increase secondary particulate formation; however, filterable PM reductions would result in an overall net PM reduction of 98.4 tpy. Changes in flue gas characteristics are not expected to impact dispersion.</td><td>OPERATIONS
CO_2 Capture Facility
Same as Scenario A.</td><td>OPERATIONS
CO_2 Capture Facility
Same as Scenario A.</td></tr>
<tr><td>Pipeline Corridors
• Negligible. Emissions of VOCs, CO, NO_x, SO_2, and particulates would occur from routine maintenance on the pipeline. These emissions would be minimal when compared to regional sources and would have a negligible impact on air quality</td><td>Pipeline Corridors
Same as Scenario A.</td><td>Pipeline Corridors
Same as Scenario A.</td></tr>
</table>

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Air Quality and Climate *(Cont'd)*			
	Injection Well Sites • *Negligible.* Emissions of VOCs, CO, NO_x, SO_2, and particulates would occur from routine maintenance at the injection well sites. These emissions would be minimal when compared to regional sources and would have a negligible impact on air quality.	**Injection Well Sites** *Same as Scenario A.*	**Injection Well Sites** *Same as Scenario A.*
Greenhouse Gases			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to GHG emissions.	**CONSTRUCTION** **CO_2 Capture Facility** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the CO_2 capture facility would generate GHGs amounting to approximately 10,124 metric tons of CO_2-eq. **Pipeline Corridors** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the pipeline corridors would generate GHGs amounting to approximately 513 metric tons CO_2-eq. **Injection Well Sites** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the injection wells would generate GHGs amounting to approximately 26,609 metric tons of CO_2-eq.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the pipeline corridors would generate GHGs amounting to approximately 4,713 metric tons of CO_2-eq. **Injection Well Sites** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the injection wells would generate GHGs amounting to approximately 39,913 metric tons of CO_2-eq.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Approximately 6,017 metric tons of CO_2-eq would be generated during construction of the pipeline corridors. **Injection Well Sites** • *Minor.* See Section 4.2 Potential Cumulative Impacts. Construction of the injection wells would generate GHGs amounting to approximately 53,218 metric tons of CO_2-eq.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Greenhouse Gases *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to GHG emissions.	**OPERATIONS** **CO_2 Capture Facility** • *Beneficial.* See Section 4.2 Potential Cumulative Impacts. Operations would capture and store approximately 1.5 million metric tpy of CO_2-eq. **Pipeline Corridors** • *Negligible.* During operations, no GHGs are generated by the pipelines, except for negligible vehicle emissions during maintenance. **Injection Well Sites** • *Negligible.* During operations, no GHGs are generated by the pipelines, except for negligible vehicle emissions during maintenance.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.*
Geology			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to geologic resources.	**CONSTRUCTION** **CO_2 Capture Facility** • *Negligible.* The facility would be constructed on an existing industrial site. **Pipeline Corridors** • *Minor.* Construction would occur along existing electrical transmission lines, and underground as much as possible. Tractor ripping and blasting may be used to place the pipeline within bedrock. • *Negligible.* Pipelines would not cross surface or underground mining operations.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Minor.* The longer length of pipeline required for this scenario may require additional bedrock excavation.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Minor.* The longer length of pipeline required for this scenario may require additional bedrock excavation.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Geology *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to geologic resources.	**Injection Well Sites** • *Minor.* The potential impacts associated with local CO_2 geologic storage are largely associated with the possibility of CO_2 migrating through fractures in the caprock seal; however, vertical migration of CO_2 would be highly unlikely. • *Minor.* Studies of the target injection formations show that they may have sufficient porosity and permeability to contain expected volumes of the CO_2, and sufficient caprock layers to prevent the CO_2 from moving upward. • *Minor.* Preliminary CO_2 plume analysis shows that the CO_2 may extend 2 miles from the Rose Run injection wells and 3 miles from the Copper Ridge wells. • *Minor.* The operation of injection wells would not preclude coal mining in the ROI.	**Injection Well Sites** • *Minor.* The additional wells would increase the total size of the CO_2 plume within the ROI. The plume radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.	**Injection Well Sites** • *Minor.* The additional wells would increase the total size of the CO_2 plume within the ROI. The plume radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.
	OPERATIONS **CO_2 Capture Facility** • *Negligible.* Operations would occur in an existing disturbed area and would not produce additional, new impacts. **Pipeline Corridors** • *Negligible.* The pipeline would not disturb geologic media during operation.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Geology *(Cont'd*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to geologic resources.	**Injection Well Sites** • *Minor.* The potential impacts associated with local CO_2 geologic storage are largely associated with the possibility of CO_2 migrating through fractures in the caprock seal; however, vertical migration of CO_2 would be highly unlikely. • *Minor.* Studies of the target injection formations show that they may have sufficient porosity and permeability to contain expected volumes of the CO_2, and sufficient caprock layers to prevent the CO_2 from moving upward. • *Minor.* Preliminary CO_2 plume analysis shows that the CO_2 may extend 2 miles from the Rose Run injection wells and 3 miles from the Copper Ridge wells. • *Minor.* The operation of injection wells would not preclude coal mining in the ROI.	**Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Minor.* The additional wells would increase the total size of the CO_2 plume within the ROI. The plume radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.	**Injection Well Sites** *Same as Scenarios A & B unless otherwise noted below.* • *Minor*. The additional wells would increase the total size of the CO_2 plume within the ROI. The plume radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.
Physiography and Soils			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to physiography and soils.	**CONSTRUCTION** **CO_2 Capture Facility** • *Negligible to Minor.* Up to 33 acres of previously disturbed urban land would be disturbed. • *Negligible.* No HEL/PHEL or prime farmland/farmland of statewide importance mapped in study area, and soils have been previously disturbed. • *Minor.* During construction, increased potential for soil erosion and compaction, although reduced by BMPs; creation of impermeable surfaces.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Physiography and Soils *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to physiography and soils.	**Pipeline Corridors** • *Negligible to Minor.* Land-disturbing activities conducted to support the construction of the pipeline corridors would disturb sensitive or high productivity soils: ▪ Acres of prime farmland: 6 ▪ Acres of farmland of statewide importance: 13 ▪ Acres of HEL: 15 ▪ Acres of PHEL: 11 • *Negligible*. No pipeline soil disturbance associated with the wells at Mountaineer Plant.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Moderate.* Land-disturbing activities conducted to support the construction of the pipeline corridors would temporarily disturb large areas of sensitive or high productivity soils up to (depending on route option): ▪ Acres of prime farmland: 13 ▪ Acres of farmland of statewide importance: 44 ▪ Acres of HEL: 97 ▪ Acres of PHEL: 22 • *Minor.* During construction, project would be done in phases thereby reducing the overall impact to the construction ROW soils. • *Moderate.* Large areas of HEL soils would be disturbed by construction activities increasing the potential for soil erosion.	**Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Moderate.* Land-disturbing activities conducted to support the construction of the pipeline corridors would temporarily disturb large areas of sensitive or high productivity soils up to (depending on route option): ▪ Acres of prime farmland: 18 ▪ Acres of farmland of statewide importance: 83 ▪ Acres of HEL: 155 ▪ Acres of PHEL: 29
	Injection Well Sites • *Negligible to Minor.* Land-disturbing activities conducted to support the construction of the injection well sites would temporarily disturb sensitive or high productivity soils: ▪ Acres of farmland of statewide importance: 3.4 ▪ Acres of HEL: 4.9 • *Minor.* Land-disturbing activities conducted to support the local CO_2 injection well site would temporarily increase soil erosion potential. Compaction of soils would reduce future soil productivity. • *Negligible.* Only small areas impacted; BMPs would be used to reduce soil erosion	**Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Minor.* Construction of the 6 injection well sites would temporarily disturb up to 15.3 acres of farmland of statewide importance and 13.5 acres of HEL.	**Injection Well Sites** *Same as Scenarios A & B unless otherwise noted below.* • *Minor.* Construction of the 8 injection well sites would temporarily disturb up to 19.5 acres of farmland of statewide importance and 17.1 acres of HEL.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Physiography and Soils *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to physiography and soils.	**OPERATIONS** **CO_2 Capture Facility** • *Negligible.* Areas not covered with impermeable surfaces would be landscaped and maintained for minimal erosion. **Pipeline Corridors** • *Minor*: Higher probability of erosion of disturbed soils, especially combined with many HEL and PHEL soils along the pipeline corridors **Injection Well Sites** • *Negligible.* Operation activities would impact less than an acre of either prime farmland, farmland of statewide importance, HEL, or PHEL.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Minor.* Potentially productive farmland would not be accessible for future farming; higher potential of erosion from operational activities. • *Negligible.* Individual injection well sites impact less than an acre of sensitive soils each.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.*
Groundwater			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states andthere would be no changes to groundwater resources.	**CONSTRUCTION** **CO_2 Capture Facility** • *Negligible.* The system would be constructed on an open industrial site. Construction activities would be covered under the Plant NPDES permit and a project Stormwater Construction Permit. **Pipeline Corridors** • *Negligible.* Construction would occur along existing electrical transmission lines, and underground as much as possible. Pipelines would be constructed above the water table.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Negligible.* The longer length of pipelines required for this scenario would increase the potential groundwater exposure to construction operations. However, spills would be cleaned in accordance with construction spill plans.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Negligible.* The longer length of pipelines required for this scenario would increase the potential groundwater exposure to construction operations. However, spills would be cleaned in accordance with construction spill plans.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Groundwater *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to groundwater resources.	**Injection Well Sites** • *Negligible.* Injection wells would be constructed so that drilling mud does not interact with local groundwater. The injection wells would be constructed under the appropriate UIC permit	**Injection Well Sites** *Same as Scenario A.*	**Injection Well Sites** *Same as Scenario A.*
	OPERATIONS **CO_2 Capture Facility** • *Negligible.* Operations would occur in an existing disturbed area and would not produce additional, new impacts. • *Minor.* The project would require potable water for 38 new employees, which is 0.7 percent of the unused capacity of the supplying sanitary district.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *Negligible.* The pipeline would not impact groundwater during operation.	**Pipeline Corridors** *Same as Scenario A.*	**Pipeline Corridors** *Same as Scenario A*
	Injection Well Sites • *Minor.* The potential impacts associated with local CO_2 geologic storage are largely associated with the possibility of CO_2 migration through fractures in the caprock seal; however, vertical migration of CO_2 would be highly unlikely. The injection wells would be operated and monitored in accordance with the appropriate UIC permit. *(Cont'd)*	**Injection Well Sites** *Same as Scenario A unless otherwise noted below* • *Minor.* The additional wells would increase the total size of the CO_2 foot print within the ROI. The CO_2 radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.	**Injection Well Sites** *Same as Scenario A unless otherwise noted below* • *Minor.* The additional wells would increase the total size of the CO_2 foot print within the ROI. The CO_2 radius would increase the surface area between the CO_2 and the caprock, but would lower the formation pressure over a greater area.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Groundwater *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to groundwater resources.	**Injection Well Sites** *(Cont'd)* • *Minor.* Vertical migration of CO_2 would be highly unlikely, as the target formation is over 7,000 feet from the deepest USDW. • *Negligible.* The potential for aquifer acidification is low because the dissolved CO_2 would be trapped within the target formation and not reach the deepest USDW. • *Negligible.* There is no aquifer management plan for Mason County.		
Surface Water			
CONSTRUCTION AND OPERATIONS *None.* The site and corridors would remain in their existing states and there would be no changes to surface waters.	**CONSTRUCTION** **CO_2 Capture Facility** • *Minor.* During storm events, the Ohio River may experience an increased sediment load due to the erosion of exposed soils during construction. • *Minor.* Potential for surface water contamination from hazardous material spills that could occur during construction activities. **Pipeline Corridors** • *Minor.* Potential for surface water contamination from hazardous material spills that could occur during construction activities. *(Cont'd)*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Minor to moderate.* Potential surface water impacts during construction of CO_2 pipeline crossings using trenching methods includes stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation: *(Cont'd)*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Minor to moderate.* Potential surface water impacts during construction of CO_2 pipeline crossings using trenching methods includes stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation: *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Surface Water *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The site and corridors would remain in their existing states and there would be no changes to surface waters.	**Pipeline Corridors** *(Cont'd)* • *Minor.* Potential surface water impacts during construction of CO_2 pipeline crossings using trenching methods includes stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation: ▪ Number of perennial stream/creek Crossings: 1 ▪ Number of intermittent stream/creek crossings: 2 ▪ Number of ephemeral stream crossings: 4 ▪ Number of pond/lake crossings: 0	**Pipeline Corridors***(Cont'd)* ▪ Maximum number of perennial stream/creek crossings: 10 ▪ Maximum number of intermittent stream/creek crossings: 24 ▪ Maximum number of ephemeral stream crossings: 32 ▪ Number of pond/lake crossings: 0	**Pipeline Corridors***(Cont'd)* ▪ Maximum number of perennial stream/creek crossings: 12 ▪ Maximum number of intermittent stream/creek crossings: 35 ▪ Maximum number of ephemeral stream crossings: 60 ▪ Number of pond/lake crossings: 0
	Injection Well Sites • *Minor.* Temporary adverse impacts to adjacent surface waters, such as sedimentation and surface water turbidity from runoff could occur during construction of the wells. • *Minor.* Drilling of wells would possibly require the discharge of well water to the surface; temporary impacts to surface waters could occur as a result of well installation. • *Minor.* Potential for surface water contamination from spills that could occur during construction activities.	**Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Minor.* Potential surface water impacts during construction of CO_2 pipeline spur crossings using trenching methods includes stream diversion/piping flows around the crossing, increased turbidity and sedimentation during streambed disturbance, change of flow or velocity, and removal of streambank vegetation: ▪ Number of perennial stream/creek crossings: 0 ▪ Min/Max number of intermittent stream/creek crossings: 2/4 ▪ Min/Max number of ephemeral stream crossings: 3/7 ▪ Number of pond/lake crossings: 0	**Injection Well Sites** *Same as Scenario B.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Surface Water *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The site and corridors would remain in their existing states and there would be no changes to surface waters**.**	**OPERATIONS** **CO_2 Capture Facility** • *Minor.* Permanent establishment of 11.5 acres of impervious cover in former grassy areas would increase the amount of pollutants and runoff into receiving waters. • *Minor.* Potential for surface water contamination from hazardous materials spills that could occur during operational activities.	**OPERATIONS** **CO_2 Capture Facility** Same as Scenario A.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *Negligible.* Occasional maintenance may require access to buried pipelines; normal operations would not affect surface waters. • *Negligible.* Potential for surface water contamination from hazardous materials spills could occur during maintenance activities.	**Pipeline Corridors** *Same as Scenario A.*	**Pipeline Corridors** *Same as Scenario A.*
	Injection Well Sites • *Negligible.* Potential for surface water contamination from hazardous materials spills that could occur during maintenance activities.	**Injection Well Sites** *Same as Scenario A.*	**Injection Well Sites** *Same as Scenario A.*
Wetlands and Floodplains			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**CONSTRUCTION** **CO_2 Capture Facility** • *Wetlands - Minor*. No wetlands exist at the CO_2 capture facility and barge unloading area; however, a wetland near the barge unloading area may experience minor impacts of sedimentation. *(Cont'd)*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	**Scenario A** ***(Lower Bound)***	**Scenario B**	**Scenario C** ***(Upper Bound)***
Wetlands and Floodplains *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**CO_2 Capture Facility** *(Cont'd)* • *Floodplains - Minor*. Entire 33-acre area is considered floodplain (13 acres of which is 100-year), though site changes since the flood mapping occurred have resulted in most of the site being elevated above the base flood elevation. In addition, the land area for upgrades to the existing barge unloading area is located entirely within 100-year floodplain below the base flood elevation. Presence of construction equipment and materials would represent minor obstructions to flood flows. • *Floodplains - Minor*. Upgrades to the barge unloading area would be expected to cause a negligible impact on flood hazards as the lowered river bank may allow a marginal increase in onsite floodwaters over a relatively small area during a flooding event. Structures in 100-year floodplains would be elevated or flood proofed as per the Mason County Floodplain Ordinance to protect the safety of workers at the facility.		

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Wetlands and Floodplains *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**Pipeline Corridors** • *Wetlands - Minor*. Construction would cause soil disturbances and compaction that can alter wetland hydrology. Riverine wetlands would be temporarily disturbed for pipeline installation; however, these features would be restored after construction. Palustrine wetlands would incur long-term type conversions due to vegetation clearing. (Wetland areas affected in construction ROWs: 5.23 acres of palustrine; 0.13 acres of riverine). • *Floodplains - None*. No mapped floodplains would be crossed by the pipeline corridors.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted.* • *Wetlands - Minor*. Palustrine wetlands would incur long-term type conversions due to vegetation clearing. (Wetland areas affected in construction ROWs: 5.51 acres of palustrine; between 0.62 and 0.83 acres of riverine). • *Floodplains* – Same as Scenario A.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted.* • *Wetlands - Minor*. Palustrine wetlands would incur long-term type conversions due to vegetation clearing. (Wetland areas affected in construction ROWs: 5.51 acres of palustrine; between 1.01 and 1.22 acres of riverine). • *Floodplains - Minor*. The Western Sporn Route would cross a 100-year floodplain (Zone A) associated with Broad Run (1.35 acres affected in construction ROW outside of permanent ROW). • *Floodplains - Minor*. The temporary presence of construction equipment and spoil piles would cause a minor temporary direct impact of placing materials within the floodplain that could redirect flood flows in the event a flooding incident occurred during construction in the floodplain.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Wetlands and Floodplains *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**Injection Well Sites** • *Wetlands - Minor.* Construction could cause sedimentation to riverine wetlands in access road construction ROWs. (Wetland areas affected in construction ROWs outside of permanent ROWs: up to 0.001 acre of riverine). Impacts could be none if injection well site infrastructure is ultimately developed that would not impact wetlands per AEP's siting criteria. • *Floodplains - None*. No mapped floodplains would be affected.	**Injection Well Sites** • *Wetlands - Minor.* Construction would cause soil disturbances and compaction that can alter wetland hydrology. Riverine wetlands would be temporarily disturbed for pipeline spur installation; however, these features would be restored after construction. (Wetland areas affected in construction ROWs outside of permanent ROWs: up to 0.029 acre of riverine). Construction could cause sedimentation to riverine wetlands in well construction laydown areas. (Wetland areas affected in laydown areas outside of operational areas: up to 0.033 acre of riverine). Construction could cause sedimentation to riverine wetlands in access road construction ROWs. (Wetland areas affected in construction ROWs outside of permanent ROWs: up to 0.002 acre of riverine). Impacts could be none if injection well site infrastructure is ultimately developed that would not impact wetlands per AEP's siting criteria. • *Floodplains - None*. No mapped floodplains would be affected.	**Injection Well Sites** • *Wetlands - Minor.* Construction would cause soil disturbances and compaction that can alter wetland hydrology. Riverine wetlands would be temporarily disturbed for pipeline spur installation; however, these features would be restored after construction. (Wetland areas affected in construction ROWs outside of permanent ROWs: up to 0.029 acre of riverine). Construction could cause sedimentation to riverine wetlands in well construction laydown areas. (Wetland areas affected in laydown areas outside of operational areas: up to 0.033 acre of riverine). Construction could cause sedimentation to riverine wetlands in access road construction ROWs. (Wetland areas affected in construction ROWs outside of permanent ROWs: up to 0.002 acre of riverine). Impacts could be none if injection well site infrastructure is ultimately developed that would not impact wetlands. • *Floodplains - Negligible.* The Western Sporn Tract injection well location (WS-1) would be outside, but close to a 100-year floodplain (Zone A) associated with Tenmile Creek. Ground disturbing activities could cause negligible amounts of sedimentation to the floodplain. Impacts could be none if injection well site infrastructure is ultimately developed further from the floodplain area.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Wetlands and Floodplains *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**OPERATIONS** **CO_2 Capture Facility** • *Wetlands - Minor*. No wetlands exist at the CO_2 capture facility. • *Floodplains - Minor*. The entire CO_2 capture facility would be located within mapped floodplains (though most of the area has been elevated above the mapped base flood elevation), which would cause obstructions that could increase flood elevations upstream and redirect flood flows; within 100-year floodplain would be the Refrigeration Area (approximately 22,400 square feet in land area) and a small portion of the Electric / Control Room / Lab Building (the Cooling Tower and Reagent Storage structures may also be present).	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *Wetlands - Minor*. No operational impacts would be expected for riverine wetlands, unless a pipeline had to be exposed for maintenance. Palustrine wetlands could incur permanent type conversions due to vegetation clearing (Wetland areas affected in permanent ROWs: 2.59 acres of palustrine; 0.04 acre of riverine). • *Floodplains - None*. No mapped floodplains would be crossed by the pipeline corridors.	**Pipeline Corridors** • *Wetlands - Minor*. No operational impacts would be expected for riverine wetlands, unless a pipeline had to be exposed for maintenance. Palustrine wetlands could incur permanent type conversions due to vegetation clearing. (Wetland areas affected in permanent ROWs: 2.70 acres of palustrine; between 0.26 and 0.33 acre of riverine). • *Floodplains - None*. No mapped floodplains would be crossed by the pipeline routes.	**Pipeline Corridors** • *Wetlands - Minor*. No operational impacts would be expected for riverine wetlands, unless a pipeline had to be exposed for maintenance. Palustrine wetlands could incur permanent type conversions due to vegetation clearing (Wetland areas affected in permanent ROWs: 2.70 acres of palustrine; between 0.46 and 0.52 acres of riverine). • *Floodplains - Negligible.* The Western Sporn Route would cross a 100-year floodplain (Zone A) associated with Broad Run (0.51 acre affected in permanent ROW). No impacts would be expected as no aboveground features would be developed that could change flood elevations or redirect flood flows.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Wetlands and Floodplains *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to wetlands and floodplains.	**Injection Well Sites** • *Wetlands - None*. No wetlands would be affected in permanent ROWs or well pad areas. • *Floodplains - None*. No mapped floodplains would be affected.	**Injection Well Sites** • *Wetlands - Minor.* No operational impacts would be expected for riverine wetlands, unless a pipeline had to be exposed for maintenance. (Wetland areas affected in permanent ROWs: up to 0.03 acre of riverine). One well pad could require filling riverine wetlands, though the footprint of the potentially impacting well pad (ES-1) would be adjusted to avoid impacts if practicable (Wetland area potentially affected in well pad area: up to <0.001 acre of riverine). • One access road could require filling riverine wetlands, though the footprint of the potentially impacting access road (to ES-2) would be adjusted to avoid impacts if practicable (Wetland area potentially affected in access road permanent ROW: up to 0.001 acre of riverine). Impacts could be none if injection well site infrastructure is ultimately developed that would not impact wetlands per AEP's siting criteria. • *Floodplains - None*. No mapped floodplains would be affected.	**Injection Well Sites** *Same as Scenario B unless otherwise noted.* • *Floodplains - Negligible.* The Western Sporn Tract injection well location (WS-1) would be outside, but close to a 100-year floodplain (Zone A) associated with Tenmile Creek. Ground disturbing activities could cause negligible amounts of sedimentation to the floodplain. Impacts could be none if injection well site infrastructure is ultimately developed that further from the floodplain area.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Biological Resources			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to biological resources.	**CONSTRUCTION** **CO_2 Capture Facility** • *Negligible.* Up to 33 acres of disturbed industrial developed open space (i.e., grassy areas) would be disturbed; developed open space area is of low wildlife habitat quality. • *Minor.* Site preparation activities associated with the proposed upgrades to the existing barge unloading area could cause temporary indirect impacts to aquatic species from sedimentation, however, implementation of erosion and sedimentation measures would be employed during construction to reduce the potential for adverse impacts. The use of temporary piles during unloading has the potential for minor localized impacts to aquatic habitat and the potential for adverse impacts to less mobile aquatic species (e.g., mussels).	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *Minor.* Land-disturbing activities conducted to support the construction of the pipeline corridors would disturb vegetated habitats from use by wildlife: ▪ Acres of Agricultural Land: 0 – 12.5 ▪ Acres of Forest: 10.4 – 36.7 ▪ Acres of Grassland and Shrub/scrub: 13.5 – 105.1 • *Negligible.* Habitat fragmentation would be avoided through the use of existing ROWs to the extent practicable. • *Minor to Moderate.* Following construction, an increased potential exists for the introduction and spread of invasive species, particularly in areas once forest. *(Cont'd)*	**Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Moderate.* Land-disturbing activities conducted to support the construction of the pipeline corridors would disturb vegetated habitats from use by wildlife: ▪ Acres of Agricultural Land: up to 10.0 ▪ Acres of Forest: up to 47.9 ▪ Acres of Grassland and Shrub/scrub: up to 118.3 • *Minor.* During construction, potential exists for temporary disturbance to streams and aquatic habitat at locations where the pipeline would cross streams.	**Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Moderate.* Land-disturbing activities conducted to support the construction of the pipeline corridors would disturb vegetated habitats from use by wildlife: ▪ Acres of Agricultural Land: up to 22.5 ▪ Acres of Forest: up to 62.4 ▪ Acres of Grassland and Shrub/scrub: up to 160.0

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Biological Resources *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to biological resources.	**Pipeline Corridors** *(Cont'd)* • *Minor.* Accidental mortality of wildlife could occur due to collisions with construction vehicles and equipment; a majority of the wildlife would avoid construction sites due to human presence and noise generated. • *Negligible.* If the potential exists for adverse impacts to migratory birds, AEP would coordinate with the USFWS to develop appropriate measures to minimize impacts to assure compliance with the MBTA. **Injection Well Sites** • *Negligible.* Land-disturbing activities conducted for the injection well sites would be located in developed locations. • *Negligible.* Due to the developed nature of the sites, the clearing of vegetation would not be anticipated to affect migratory bird nesting.	**Injection Well Sites** • *Minor.* Land-disturbing activities conducted for the injection well sites would temporarily remove up to 11.3 acres of forest. • *Negligible.* If the potential exists for adverse impacts to migratory birds, AEP would coordinate with the USFWS to develop appropriate measures to minimize impacts to assure compliance with the MBTA.	**Injection Well Sites** • *Minor.* Land-disturbing activities conducted for the injection well sites would temporarily remove up to 16.4 acres of forest.
	OPERATIONS **CO_2 Capture Facility** • *Negligible.* Operations would occur in an existing disturbed area and would not produce additional, new impacts.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenarios A & B.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Biological Resources *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to biological resources.	**Pipeline Corridors** • *Negligible to Minor.* During operations, biological resource impacts within the pipeline corridors would be limited to permanent habitat conversion and maintenance activities within the permanent ROW: ▪ Acres of Agricultural Land: 0 ▪ Acres of Forest: 4.3 ▪ Acres of Grassland and Shrub/scrub: 5.5 • *Negligible.* Soil invertebrates or plant roots could experience elevated CO_2 soil concentrations close to the segment of the pipeline if a rupture or leak occurred.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Moderate.* During operations, biological resource impacts within the pipeline corridors would be limited to permanent habitat conversion and maintenance activities within the permanent ROW: ▪ Acres of Agricultural Land: up to 8.3 ▪ Acres of Forest: up to 32.5 ▪ Acres of Grassland and Shrub/scrub: Up to 84.6 • *Moderate.* Localized habitat fragmentation would occur from establishment of permanent ROWs within new areas.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Moderate.* During operations, biological resource impacts within the pipeline corridors would be limited to permanent habitat conversion and maintenance activities within the permanent ROW: ▪ Acres of Agricultural Land: up to 12.0 ▪ Acres of Forest: up to 38.5 ▪ Acres of Grassland and Shrub/scrub: up to 126.7
	Injection Well Sites • *Negligible.* Operations would be located in previously developed locations. • *Negligible.* CO_2 sequestration has the potential to alter localized microbial communities by changing the pH of the underground environment; however, impacts would likely have negligible to minor impacts to microbial communities.	**Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Negligible.* During operations, biological resource impacts within the injection well sites would be limited to permanent habitat conversion and maintenance activities within the injection well sites: 2.1 acres of grassland and shrub/scrub habitat and 4.7 acres of forest. • *Minor.* Indirect impacts would occur from the increased potential of introduction and spread of invasive species due to human activity.	**Injection Well Sites** *Same as Scenarios A & B unless otherwise noted below.* • *Negligible.* During operations, biological resource impacts within the injection well sites would be limited to permanent habitat conversion and maintenance activities within the injection well sites: 2.1 acres of grassland and shrub/scrub habitat and 5.2 acres of forest.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Cultural Resources			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to cultural resources.	**CONSTRUCTION** **CO_2 Capture Facility** • *None.* Construction of the CO_2 capture facility would result in the disturbance of previously disturbed land; therefore, no impact to archaeological resources would occur. • *None.* No impact to the two historic resources identified by DOE would occur as a result of construction of the CO_2 capture facility. **Pipeline Corridors** • *None.* A Phase I identified no archaeological sites within the APE for the pipeline corridors; therefore, no impacts to archaeological resources would be expected. • *None.* No historic resources are located within the APE for the pipeline corridors; therefore, no impacts to historic resources are anticipated. **Injection Well Sites** • *None.* A Phase I identified no archaeological sites within the APE; therefore, no impacts to archaeological resources would be expected. • AEP would likely be required to install monitoring wells as part of the permitting process. Should wells be installed on portions of the property that have not been surveyed, a Phase I archaeological survey would be conducted for the monitoring well sites. Based on siting criteria, it is anticipated that archaeological resources would be avoided	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Cultural Resources *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to cultural resources.	**OPERATIONS** **CO_2 Capture Facility** • *None.* No impact to archaeological resources would occur during operation of the CO_2 capture facility. • *Negligible.* A negligible impact to the two historic resources identified by DOE could occur from the operation of the CO_2 capture facility.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *None.* A Phase I identified no archaeological sites within the APE; therefore, no impacts to archaeological resources would be expected. • *None.* No historic resources are located within the APE of the pipeline corridors; therefore, no impacts to historic resources are anticipated.	**Pipeline Corridors** *Same as Scenario A.*	**Pipeline Corridors** *Same as Scenario A.*
	Injection Well Sites • *None.* No impact to archaeological resources would occur during operation of the injection wells. • *Negligible.* A negligible impact to the two historic resources identified by DOE could occur from the operation of the injections wells.	**Injection Well Sites** *Same as Scenario A.*	**Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Land Use and Aesthetics			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to land use.	**CONSTRUCTION** **CO_2 Capture Facility** • *Negligible.* Construction at the 33-acre project site would impact previously-disturbed, industrial open space (grassy areas). Adjacent areas are developed/disturbed lands. • *Negligible.* Construction would have a negligible short-term impact on land use and aesthetic resources on neighboring residential properties. Nearest residence is 2,600 feet to the west.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*
	Pipeline Corridors • *Negligible.* Land-disturbing activities conducted to support the construction of pipeline corridors would not permanently impact land use along an existing power transmission easement. No agricultural land use would be impacted. • *Negligible.* Construction of the pipeline corridors would result in negligible short-term impacts on land use and aesthetic resources in the surrounding area, which is industrial land owned by AEP. No residential receptors are located within 1,000 feet of the pipeline. No new ROW through private property would be created. • *Negligible.* Land within temporary ROW could revert back to previous land use after construction.	**Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Minor.* Land-disturbing activities conducted to support the construction of the pipeline corridors would temporarily impact up to 19.6 acres of agricultural land use. • *Minor.* Construction of pipelines would cause short-term impacts on land use and aesthetic resources on up to 31 nearby residential receptors from construction noise, truck traffic, and emissions, mainly fugitive dust. • *Minor.* Construction would impact land use along route options that include the creation of new ROW through private property. Up to 4.0 miles of new ROW would be created.	**Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Minor.* Land-disturbing activities conducted to support the construction of the pipeline corridors would temporarily impact up to 32.1 acres of agricultural land use. • *Minor.* Construction of pipelines would cause short-term impacts on land use and aesthetic resources on up to 73 nearby residential receptors from construction noise, truck traffic, and emissions, mainly fugitive dust. • *Minor.* Construction would impact land use along route options that include the creation of new ROW through private property. Up to 5.2 miles of new ROW would be created.
	Injection Well Sites • *Negligible.* Construction of wells, pipeline spurs, and access roads would impact natural ground cover and previously disturbed land. No agricultural land would be affected. *(Cont'd)*	**Injection Well Sites** *Same as Scenario A unless otherwise noted below. (Cont'd)*	**Injection Well Sites** *Same as Scenario A unless otherwise noted below. (Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Land Use and Aesthetics *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to land use.	**Injection Well Sites** *(Cont'd)* • *Negligible.* Construction at the injection well sites would result in negligible short-term impacts on land use and aesthetic resources in the surrounding area, which is industrial land owned by AEP. No residential receptors are located within 1,000 feet of the injection well sites.	**Injection Well Sites** *(Cont'd)* • *Minor.* Construction at the injection well properties would result in minor short-term impacts on land use and aesthetic resources at nearby residential properties from construction noise, truck traffic, and emissions, mainly fugitive dust. The nearest residence to an injection well site at the Eastern Sporn Tract is 380 feet and to the Jordan Tract is 1,210 feet.	**Injection Well Sites** *(Cont'd)* • *Minor.* Construction at the injection well properties would result in minor short-term impacts on land use and aesthetic resources at nearby residential properties from construction noise, truck traffic, and emissions, mainly fugitive dust. The nearest residence to an injection well site at the Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract is 380 feet, 1,210 feet, and 580 feet, respectively.
	OPERATIONS **CO_2 Capture Facility** • *Negligible.* Operation of the CO_2 capture facility would have a negligible long-term impact on the industrial land use within the Mountaineer Plant property. The CO_2 capture facility would be compatible with land use on the surrounding lands, also owned by AEP. • *Negligible.* Operation of the CO_2 capture facility would have a negligible long-term impact on land use and aesthetic resources on neighboring residential properties due to the distances involved (2,600 ft). **Pipeline Corridors** • *Negligible.* Land-disturbing activities conducted to support the construction of the pipeline corridors would permanently impact land along an existing electrical transmission easement. No agricultural land use would be permanently impacted. *(Cont'd)*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenario A unless otherwise noted below.* • *Minor.* Land-disturbing activities conducted to support the construction of the pipeline corridors would permanently impact up to 8.3 acres of agricultural land. *(Cont'd)*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* **Pipeline Corridors** *Same as Scenarios A & B unless otherwise noted below.* • *Minor.* Up to 12.0 acres of agricultural land would be included in a permanent easement. *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Land Use and Aesthetics *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to land use.	**Pipeline Corridors** *(Cont'd)* • *Negligible.* Operations within the pipeline corridor would result in negligible long-term impacts on land use and aesthetic resources on the surrounding property, which is industrial land owned by AEP. No residential receptors are located within 1,000 feet of the pipeline. No new ROW through private property would be created. • *Negligible.* Land within temporary ROW could revert back to previous land use after construction.	**Pipeline Corridors** *(Cont'd)* • *Minor.* Operation of the pipelines corridors would result in minor long-term impacts on land use and aesthetic resources on up to 31 nearby residential receptors, due to concern for concern for human health and safety, which is discussed in Section 3.14, Human Health and Safety. • *Minor.* Operations within the pipeline corridors would result in minor long-term impacts to land use along route options that include the creation of new ROW through private property. Up to 4.0 miles of new ROW would be created. • *Minor.* Lands above the pipeline would return to the current land use after construction; restrictions would apply to the ROWs requiring access for maintenance and would limit construction of permanent structures above the pipelines.	**Pipeline Corridors** *(Cont'd)* • *Minor.* Operation of the pipeline corridors would result in minor long-term impacts on land use and aesthetic resources on up to 73 nearby residential receptors, due to concern for human health and safety, which is discussed in Section 3.14, Human Health and Safety. • *Minor.* Operations within the pipeline corridors would result in minor long-term impacts to land use along route options that include the creation of new ROW through private property. Up to 5.2 miles of new ROW would be created.
	Injection Well Sites • *Negligible.* Operations conducted to support the local CO_2 injection well site would result in permanent loss of natural land cover. No agricultural land would be impacted. • *Minor.* Operations at both injection well sites would have a minor long- term impact as the permanent land use would be used for CO_2 injection. • *Negligible.* Operations at both injection well sites would have a negligible impact on aesthetic resources on neighboring properties that are owned by AEP. No residential properties are located within 1,000 feet of the injection well sites.	**Injection Well Sites** *Same as Scenario A unless otherwise noted below.* • *Minor.* Operations at the injection well sites would result in minor long-term impacts on land use and aesthetic resources at nearby residential properties, due to concern for human health and safety, which is discussed in Section 3.14, Human Health and Safety. The nearest residence to an injection well site at the Eastern Sporn Tract is 380 feet and to the Jordan Tract is 1,210 feet.	**Injection Well Sites** *Same as Scenarios A & B unless otherwise noted below.* • *Minor.* Operations at the injection well properties would result in minor short-term impacts on land use and aesthetic resources at nearby residential properties, due to concern for human health and safety, which is discussed in Section 3.14, Human Health and Safety. The nearest residence to an injection well site at the Eastern Sporn Tract, Jordan Tract, and Western Sporn Tract is 380 feet, 1,210 feet, and 580 feet, respectively.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Traffic and Transportation			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to traffic and transportation.	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Moderate*. During peak construction conditions (2014), percent increase (from No-Build to Build conditions) in total daily traffic volumes on State Route 62 would range from 12 to 79 percent; percent increase in peak one-way hour traffic volumes would range from 62 to 429 percent. LOSs on State Route 62 would temporarily degrade one to three levels; LOSs would range from C to D.	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Moderate*. Because the majority of new vehicle trips are associated with the construction of the CO_2 capture facility and would be the same for all scenarios, traffic impacts under scenario B would be similar to those under scenario A. During peak construction conditions (2014), percent increase (from No-Build to Build conditions) in total daily traffic volumes on State Route 62 would range from 12 to 85 percent; percent increase in peak one-way hour traffic volumes would range from 66 to 453 percent. LOSs on State Route 62 would temporarily degrade one to three levels; LOSs would range from C to D.	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Moderate*. Because the majority of new vehicle trips are associated with the construction of the CO_2 capture facility and would be the same for all scenarios, traffic impacts under scenario C would be slightly higher than scenario A. During peak construction conditions (2014), percent increase (from No-Build to Build conditions) in total daily traffic volumes on State Route 62 would range from 13 to 87 percent; percent increase in peak one-way hour traffic volumes would range from 69 to 477 percent. LOSs on State Route 62 would temporarily degrade one to three levels; LOSs would be around D.
	OPERATIONS **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Minor*. Percent increase (from No-Build to Build conditions) in total daily traffic volumes on State Route 62 would range from 1 to 5 percent; percent increase in peak one-way hour traffic volumes would range from 4 to 27 percent. LOSs on State Route 62 would remain similar to baseline conditions (A to C).	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Noise			
<u>CONSTRUCTION AND OPERATIONS</u> *None*. The Mountaineer Plant property, pipeline routes, and injection well properties would remain in their existing states and there would be no changes to noise levels.	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility (Stationary Noise Impacts)** • *Minor to Moderate*. Construction of the CO_2 capture facility could be audible at all identified receptor locations, with projected increases in noise levels in the range of 8.9 to 15 dBA. Predicted noise levels at nearby receptors analyzed based on one AEP study may exceed EPA guideline threshold (L_{eq} of 48.6 dBA), but within or near levels classified by HUD as "acceptable" (L_{eq} of 58.6 dBA) Discernable increases in sound levels could occur at all receptors. **Pipeline Corridors (Stationary Noise Impacts)** • *Minor*. Extent of impacts dependent on proximity to the construction site, but impacts would be temporary and limited to daylight hours. No sensitive noise receptors are known to be located within 1,000 feet of the pipeline routes. Beyond 1,000 feet, noise levels expected to be within levels classified by HUD as "acceptable."	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility (Stationary Noise Impacts)** *Same as Scenario A.* **Pipeline Corridors (Stationary Noise Impacts)** • *Minor to Moderate*. Extent of impacts primarily dependent on proximity to the construction site, but impacts would be temporary and limited to daylight hours. • For receptors located 500 feet from construction site, predicted noise levels without and with horizontal directional drilling are 64 and 67 dBA, respectively. The following lists the number of receptors within 500 feet for each pipeline route: ▪ BA Route – 0 ▪ ES Route 1 – 1 ▪ ES Route 2 – 2 ▪ ES Route 3 – 1 ▪ ES Route 4 – 3 ▪ JT Route 1 – 4 ▪ JT Route 2 – 3 ▪ JT Route 3 – 5 ▪ JT Route 4 – 4 *(Cont'd)*	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility (Stationary Noise Impacts)** *Same as Scenario A.* **Pipeline Corridors (Stationary Noise Impacts)** • *Minor to Moderate*. Extent of impacts primarily dependent on proximity to the construction site, but impacts would be temporary and limited to daylight hours. • For receptors located 500 feet from construction site, predicted noise levels without and with horizontal directional drilling are 64 and 67 dBA, respectively. The number of receptors within 500 feet for each pipeline would be the same as those listed under Scenario B, with the addition of 19 receptors for WS Route. • For receptors located 1,000 feet from construction site, predicted noise levels without and with horizontal directional drilling are 58 and 61 dBA, respectively. *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Noise *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline routes, and injection well properties would remain in their existing states and there would be no changes to noise levels.		**Pipeline Corridors** *(Cont'd)* **(Stationary Noise Impacts)** • For receptors located 1,000 feet from construction site, predicted noise levels without and with horizontal directional drilling are 58 and 61 dBA, respectively. The following lists the number of receptors within 1,000 feet for each pipeline route: ▪ BA Route – 0 ▪ ES Route 1 – 2 ▪ ES Route 2 – 12 ▪ ES Route 3 – 5 ▪ ES Route 4 – 16 ▪ JT Route 1 – 11 ▪ JT Route 2 – 11 ▪ JT Route 3 – 15 ▪ JT Route 3 – 15	**Pipeline Corridors** *(Cont'd)* **(Stationary Noise Impacts)** • The number of receptors within 1,000 feet for each pipeline would be the same as those listed under Scenario B, with the addition of 42 receptors for WS Route.
	Injection Well Sites (Stationary Noise Impacts) • *Moderate*. No receptors would be located within a distance that would result in substantial, short-term noise impacts (i.e., within 2,000 feet). The closest noise receptor is located approximately 2,500 feet (from MT-1 well) and could experience a predicted noise level of 56.1 dBA, but would be within levels classified by HUD as "acceptable." If AEP's noise evaluation determines that ambient sound levels at a receptor would experience a change greater than 5 dBA, AEP would evaluate sound mitigation measures to reduce noise levels.	**Injection Well Sites (Stationary Noise Impacts)** • *Minor to Moderate*. Extent of impacts primarily dependent on proximity to the construction site. Sound levels could reach 70.0, 64.0, and 58.0 dBA for receptors located within 500, 1,000, and 2,000 feet of the well construction site, respectively. If AEP's noise evaluation determines that ambient sound levels at a receptor would experience a change greater than 5 dBA, AEP would evaluate sound mitigation measures to reduce noise levels. *(Cont'd)*	**Injection Well Sites (Stationary Noise Impacts)** • *Minor to Moderate*. Extent of impacts primarily dependent on proximity to the construction site. Sound levels could reach 70.0, 64.0, and 58.0 dBA for receptors located within 500, 1,000, and 2,000 feet of the well construction site, respectively. If AEP's noise evaluation determines that ambient sound levels at a receptor would experience a change greater than 5 dBA, AEP would evaluate sound mitigation measures to reduce noise levels. *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Noise *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline routes, and injection well properties would remain in their existing states and there would be no changes to noise levels		**Injection Well Sites** *(Cont'd)* **(Stationary Noise Impacts)** • The following lists the number of receptors for each injection well site that could experience short-term, substantial noise impacts (within 2,000 feet and without noise mitigation measures): ▪ BA-1 – 0 ▪ ES-1, ES-2, & ES-3 – 12 ▪ JT-1 – 3	**Injection Well Sites** *(Cont'd)* **(Stationary Noise Impacts)** • The number of receptors within 2,000 feet for each injection well site that could experience short-term, substantial noise impacts (within 2,000 feet and without noise mitigation measures) would be the same as those listed under Scenario B, with the addition of 39 receptors for WS.
	Combined (Mobile Noise Impacts) • *Negligible*. Overall baseline noise levels along State Route 62 would increase slightly (by 0.3 to 1.5 dBA), but is generally not expected to be detectable.	**Combined (Mobile Noise Impacts)** • *Negligible*. Overall baseline noise levels along State Route 62 would increase slightly (by 0.3 to 1.7 dBA), but is generally not expected to be detectable.	**Combined (Mobile Noise Impacts)** • *Negligible*. Overall baseline noise levels along State Route 62 would increase slightly (by 0.4 to 1.8 dBA), but is generally not expected to be detectable.
	OPERATIONS **CO_2 Capture Facility (Stationary Noise Impacts)** • *Minor*. Predicted noise levels may exceed the EPA guidelines threshold at Receptors 1, 4, and 5, but within levels classified by HUD as "acceptable." Sound levels would range from 47.2 to 53.2 dBA at these receptors. It is not expected that clearly discernable increases in sound levels would occur at any of the receptors. Upon review of final equipment noise evaluations, AEP would incorporate sound enclosures, barriers, and/or sound dampening materials, as appropriate, to ensure that changes in noise levels at receptors do not exceed detectable levels (i.e., 5 dBA).	**OPERATIONS** **CO_2 Capture Facility (Stationary Noise Impacts)** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility (Stationary Noise Impacts)** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Noise *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline routes, and injection well properties would remain in their existing states and there would be no changes to noise levels.	**Pipeline Corridors (Stationary Noise Impacts)** • *Negligible*. The pipeline would primarily be buried, negligible noise impacts are expected. **Injection Well Sites (Stationary Noise Impacts)** • *Negligible to Moderate*. During normal operations, operation of wells expected to result in negligible noise impacts. During maintenance activities, temporary noise increase could result in moderate impacts, depending on distance to closest receptor. **Combined (Mobile Noise Impacts)** • *Negligible.* Overall baseline noise levels along State Route 62 would increase slightly, but is generally not expected to be detectable.	**Pipeline Corridors (Stationary Noise Impacts)** *Same as Scenario A.* **Injection Well Sites (Stationary Noise Impacts)** *Same as Scenario A.* **Combined (Mobile Noise Impacts)** *Same as Scenario A.*	**Pipeline Corridors (Stationary Noise Impacts)** *Same as Scenario A.* **Injection Well Sites (Stationary Noise Impacts)** *Same as Scenario A.* **Combined (Mobile Noise Impacts)** *Same as Scenario A.*
Materials and Waste Management			
	CONSTRUCTION **CO_2 Capture Facility** • *Negligible.* Construction materials are available locally and nationally. The capacity of suppliers would not be exceeded. • *Negligible.* Clearing, grubbing, and excavating would generate excess soils, sub-soils, rock, brush, and timber. The materials would be re-used by AEP or reused as raw material (timber) in the ROI to the extent possible. Otherwise, the debris would be properly disposed of in a licensed landfill. • *Negligible.* C&D debris would be generated. Recycling options would be targeted. Landfill use is at 47.9 percent of permitted capacity in West Virginia. Landfills within the ROI have sufficient capacity to accept these wastes.	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Materials and Waste Management *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well sites would remain in their existing states and there would be no changes to materials and waste management.	**Pipeline Corridors** • *Negligible*. Clearing, grubbing, and excavating would generate excess soils, sub-soils, rock, brush, and timber. The materials would be re-used by AEP or reused as raw material (timber) in the ROI to the extent possible. Otherwise, the debris would be properly disposed of in a licensed landfill.	**Pipeline Corridors** *Same as Scenario A with additional material and waste volume.*	**Pipeline Corridors** *Same as Scenario A with additional material and waste volume.*
	Injection Well Sites • *Negligible*. Drill cuttings, drilling mud, and water would require treatment, recycling, or disposal. Treatment, recycling, or disposal options are available in the ROI and would be temporary.	**Injection Well Sites** *Same as Scenario A with additional material and waste volume.*	**Injection Well Sites** *Same as Scenario A with additional material and waste volume.*
	OPERATIONS **CO_2 Capture Facility** • *Minor.* Industrial wastewater would be generated in the CAP process and treated in the new WWTP or use existing WWTP capacity. Additional sludge would be generated at the new Mountaineer WWTP from the CAP process. The relatively small amount of additional waste sludge would be disposed of in the existing AEP landfill that has capacity for the life of the project. *(Cont'd)*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Materials and Waste Management *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None*. The Mountaineer Plant property, pipeline corridors, and injection well sites would remain in their existing states and there would be no changes to materials |and waste management.	**CO_2 Capture Facility** *(Cont'd)* • *Beneficial to Moderate*. The ammonium sulfate by-product impact would be beneficial long-term if the material is used for commercial purposes, as additional energy and materials would not be required to produce this common commercial product. If the material would be landfilled, there are multiple receiving facilities available with unused capacity and a relatively long-life span that could accept this non-hazardous material (as a solid). The impact is considered moderate because of the long-term disposal requirement, if it is not beneficially used. • *Minor*. Solid waste related mainly to miscellaneous facility (worker) trash, including paper, cardboard, aluminum, and glass would be generated. A recycling program would be implemented for these non-hazardous waste streams.		

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Materials and Waste Management *(Cont'd)*			
<u>CONSTRUCTION AND OPERATIONS</u> *None*. The Mountaineer Plant property, pipeline corridors, and injection well sites would remain in their existing states and there would be no change to materials and waste management.	**Pipeline Corridors** • *Negligible*. Along the pipeline routes, additional materials would not be required. Vegetation cut during maintenance activities along the corridors would be re-used as mulch or compost on the AEP property to the extent possible. Otherwise, the debris would be properly disposed of in a licensed landfill.	**Pipeline Corridors** *Same a Scenario A with additional material and waste volume.*	**Pipeline Corridors** *Same as Scenario A with additional material and waste volume.*
	Injection Well Sites • *Minor*. Intermittent, long-term maintenance of the wells would be required, generating solid and liquid wastes. Facilities are available for treatment and disposal within the regional or national ROI.	**Injection Well Sites** *Similar to Scenario A with additional material and waste volume.*	**Injection Well Sites** *Similar to Scenario A with additional material and waste volume.*
Human Health and Safety			
<u>CONSTRUCTION AND OPERATIONS</u> *None*. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility** • *Minor.* Potential for construction accidents and injuries to workers; based on industry data could result in 13 to 16 recordable incidents over the entire 32-month construction period, but no fatalities would be anticipated.	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility** *Same as Scenario A.*	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Human Health and Safety *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.	**Pipeline Corridors** • *Minor.* Potential for construction accidents and injuries to workers from construction of pipeline. **Injection Well Sites** • *Minor.* Potential for construction accidents and injuries to workers from construction of injection wells.	**Pipeline Corridors** • *Minor. Same as Scenario A,* but with up to 18.33 miles of additional pipeline. **Injection Well Sites** • *Minor. Same as Scenario A,* but with addition of 2 injection wells.	**Pipeline Corridors** • *Minor. Same as Scenario A,* but with up to 24.02 miles of additional pipeline. **Injection Well Sites** • *Minor. Same as Scenario A,* but with addition of 4 injection wells.

OPERATIONS

CO_2 Capture Facility

Minor. Potential impacts would be the same for all scenarios. Consequences of release scenarios vary with wind direction; therefore, the impacts summary below has been prepared for three different wind directions.

The release scenarios for the operation of the CO_2 capture facility all represent unlikely events; events estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr).

Rupture of Refrigerated Anhydrous Ammonia Tank

Rupture of refrigerated anhydrous ammonia tank could result in release of 250,000 pounds of anhydrous ammonia, and potentially expose human populations to gas containing high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.

W/SSW Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<187
Irreversible adverse	<7
Life-threatening	<4

E/SE Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<1,765
Irreversible adverse	<6
Life-threatening	<3

NW Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<704
Irreversible adverse	<6
Life-threatening	<3

Rupture of Liquefied Pressure Anhydrous Ammonia Tank

Rupture of liquefied pressure anhydrous ammonia tank could result in release of 250,000 pounds of anhydrous ammonia, and potentially expose human populations to gas containing high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors

W/SSW Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<408
Irreversible adverse	<13
Life-threatening	<13

E/SE Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<2,858
Irreversible adverse	<153
Life-threatening	<11

NW Wind Direction

Type of Effect	No. Individuals
Transient and reversible	<828
Irreversible adverse	<10
Life-threatening	<11

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

<table>
<tr><th>No Action Alternative</th><th>Scenario A
(Lower Bound)</th><th>Scenario B</th><th>Scenario C
(Upper Bound)</th></tr>
<tr><td colspan="4">Human Health and Safety (Cont'd)</td></tr>
<tr><td rowspan="8"><u>CONSTRUCTION AND OPERATIONS</u>
None. The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.</td><td colspan="3">Rupture of 29-percent Aqueous Ammonia Tank
Rupture of aqueous ammonia tank could result in release of 400,000 pounds of aqueous ammonia, and potentially expose human populations to gas containing high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.</td></tr>
<tr><td>W/SSW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <25
Irreversible adverse <2
Life-threatening <3</td><td>E/SE Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <634
Irreversible adverse <2
Life-threatening <2</td><td>NW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <659
Irreversible adverse <2
Life-threatening <2</td></tr>
<tr><td colspan="3">Unloading of 80-Ton Rail Car with Anhydrous Ammonia
The release of anhydrous ammonia during unloading of an 80-ton rail car could result in potential exposure of human populations to high concentrations of NH_3. The end point distances for such a release are found in Table 3.14-9. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.</td></tr>
<tr><td>W/SSW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <161
Irreversible adverse <8
Life-threatening <9</td><td>E/SE Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <2,410
Irreversible adverse <7
Life-threatening <7</td><td>NW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <857
Irreversible adverse <7
Life-threatening <7</td></tr>
<tr><td colspan="3">Unloading of 116-Ton Rail Car with 29-percent Aqueous Ammonia
The release of aqueous ammonia during unloading of a 116-ton rail car could result in potential exposure of human populations to high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.</td></tr>
<tr><td>W/SSW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <224
Irreversible adverse <11
Life-threatening <7</td><td>E/SE Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible<2,576
Irreversible adverse <133
Life-threatening <6</td><td>NW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <857
Irreversible adverse <95
Life-threatening <6</td></tr>
<tr><td colspan="3">Unloading of 18-Ton Tank Truck with Anhydrous Ammonia
The release of anhydrous ammonia during unloading of an 18-ton tank truck could result in potential exposure of human populations to high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.</td></tr>
<tr><td>W/SSW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <27
Irreversible adverse <2
Life-threatening <2</td><td>E/SE Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <312
Irreversible adverse <2
Life-threatening <2</td><td>NW Wind Direction
<u>Type of Effect No. Individuals</u>
Transient and reversible <223
Irreversible adverse <2
Life-threatening <2</td></tr>
</table>

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
	Human Health and Safety *(Cont'd)*		
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.	**Unloading of 26-Ton Tank Truck with 29-percent Aqueous Ammonia** The release of aqueous ammonia during unloading of a 26-ton tank truck could result in potential exposure of human populations to high concentrations of ammonia. Populations exposed from such a release would be dependent on the location of the releases, the meteorological conditions (including atmospheric stability and wind speed and direction) and other factors.		
	W/SSW Wind Direction Type of Effect — No. Individuals Transient and reversible <31 Irreversible adverse <2 Life-threatening <2	**E/SE Wind Direction** Type of Effect — No. Individuals Transient and reversible <789 Irreversible adverse <2 Life-threatening <1	**NW Wind Direction** Type of Effect — No. Individuals Transient and reversible <641 Irreversible adverse <2 Life-threatening <1
	Pipeline Corridors • **CO_2 Release due to leakage from catastrophic failure of caprock or through lateral migration.** This event estimated to occur less than one time in 1 million years of facility operations. • CO_2 concentrations in ambient air for this hypothetical would be less than established health criteria, and no effects to the public would be expected. • **CO_2 Release due to pipeline rupture or puncture during operation.** These events are estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr); unlikely. • The rupture or puncture of a pipeline would release gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, and could potentially expose populations to potential health effects: *(Cont'd)*	**Pipeline Corridors** • **CO_2 Release due to leakage from catastrophic failure of caprock or through lateral migration.** This event estimated to occur less than one time in 1 million years of facility operations. *Same as Scenario A.* • **CO_2 Release due to pipeline rupture or puncture during operation.** These events are estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr); unlikely. • The rupture or puncture of a pipeline would release gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, and could potentially expose populations to potential health effects: *(Cont'd)*	**Pipeline Corridors** • **CO_2 Release due to leakage from catastrophic failure of caprock or through lateral migration.** This event estimated to occur less than one time in 1 million years of facility operations. *Same as Scenario A.* • **CO_2 Release due to pipeline rupture or puncture during operation.** These events are estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr); unlikely. • The rupture or puncture of a pipeline would release gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, and could potentially expose populations to potential health effects: *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Human Health and Safety *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.	**Pipeline Rupture** Type of Effect — No. Individuals Transient and reversible <1 Irreversible adverse <1 Life-threatening <1	**Pipeline Rupture** Type of Effect — No. Individuals *Transient and reversible* Borrow Area Route < 1 Eastern Sporn Routes < 5 Jordan Routes < 4 *Irreversible adverse* All routes <1 Life-threatening All routes <1	**Pipeline Rupture** Type of Effect — No. Individuals *Transient and reversible* Borrow Area Route < 1 Eastern Sporn Routes < 5 Jordan Routes < 4 Western Sporn Route < 3 *Irreversible adverse* All routes <1 Life-threatening All routes <1
	Pipeline Puncture Type of Effect — No. Individuals *Transient and reversible* Irreversible adverse 0 Life-threatening 0	**Pipeline Puncture** Type of Effect — No. Individuals *Transient and reversible* All segments <1 *Irreversible adverse* All segments <1 Life-threatening All segments <1	**Pipeline Puncture** Type of Effect — No. Individuals *Transient and reversible* All segments <1 *Irreversible adverse* All segments <1 Life-threatening All segments <1
	Injection Well Sites • **CO_2 release from failure of an injection well during operation.** Estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1 x 10^{-4}/yr to 1 x 10^{-6}/yr); Extremely Unlikely. • Release of gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, could expose individuals to potential health effects within 50 feet of wellhead. These effects are expected to be primarily limited to workers. Effects on non-involved workers would be transient effects from CO_2 if present within approximately 50 - 180 feet of wellhead at time of release. Potential effects to offsite receptors at the Borrow Area well from CO_2 would be: *(Cont'd)*	**Injection Well Sites** • **CO_2 release from failure of an injection well during operation.** Estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1 x 10^{-4}/yr to 1 x 10^{-6}/yr); Extremely Unlikely. • Release of gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, could expose populations to potential health effects within 50 feet of wellhead. These effects are expected to be primarily limited to workers. Effects on non-involved workers would be *same as Scenario A.* Potential effects to offsite receptors from CO_2 would be: *(Cont'd)*	**Injection Well Sites** • **CO_2 release from failure of an injection well during operation.** Estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1 x 10^{-4}/yr to 1 x 10^{-6}/yr); Extremely Unlikely. • Release of gas containing high concentrations of CO_2, and potential trace concentrations of ammonia, could expose populations to potential health effects within 50 feet of wellhead. These effects are expected to be primarily limited to workers. Effects on non-involved workers would be *same as Scenario A.* Potential effects to offsite receptors from CO_2 would be: *(Cont'd)*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Human Health and Safety *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to human health and safety.	**Injection Well Sites (***Cont'd)* Type of Effect / No. Individuals Transient and reversible 0 Irreversible adverse 0 Life-threatening 0 • **Post injection CO_2 release due to leakage from: abandoned or undocumented deep wells; existing faults; unknown structural or stratigraphic connections.** This event is estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1 x 10^{-2}/yr to 1 x 10^{-4}/yr); unlikely. • Release of CO_2 through these mechanisms would not be expected to result in concentrations in ambient air in excess of established health criteria; no effects to the public would be expected.	**Injection Well Sites (***Cont'd)* Type of Effect / No. Individuals *Transient and reversible* Borrow Area Tract 0 Eastern Sporn Tract <1 Jordan Tract <1 *Irreversible adverse (all)* 0 *Life-threatening (all)* 0 • **Post injection CO_2 release due to leakage from: abandoned or undocumented deep wells; existing faults; unknown structural or stratigraphic connections.** This event is estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1 x 10^{-2}/yr to 1 x 10^{-4}/yr); unlikely. *Same as Scenario A.*	**Injection Well Sites (***Cont'd)* Type of Effect / No. Individuals *Transient and reversible* Borrow Area Tract 0 Eastern Sporn Tract <1 Jordan Tract <1 Western Sporn <1 *Irreversible adverse (all) 0* *Life-threatening (all) 0* • **Post injection CO_2 release due to leakage from: abandoned or undocumented deep wells; existing faults; unknown structural or stratigraphic connections.** This event is estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1 x 10^{-2}/yr to 1 x 10^{-4}/yr); unlikely. *Same as Scenario A.*
Utilities			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no change to utilities.	**CONSTRUCTION** **CO_2 Capture Facility** • *Minor.* Increased demand for potable water for construction workers on entire Mountaineer CCS II Project would consume between 0.5 percent and 16 percent of the unused capacity of the NHWF. *(Cont'd)*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
	Utilities *(Cont'd)*		
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to utilities.	**CO_2 Capture Facility** *(Cont'd)* • As such, potential impacts to potable water and wastewater treatment utilities would be short term and minor. • *Negligible.* Increased demand for process water and electricity for construction of the CO_2 capture facility would be provided by the existing Mountaineer river water loop and Mountaineer Plant, respectively, and would not affect local utilities. **Pipeline Corridors** • *Negligible.* Potable water and wastewater impacts for construction workers associated with the pipeline are negligible and included in the totals presented above. Any potential impacts would be negligible. • *Negligible.* Construction water and electrical demand would not be provided by nor affect public utilities for the construction of pipelines and injection wells. **Injection Well Sites** • *Negligible.* Potable water and wastewater impacts for construction workers associated with the injection well sites are negligible. Any potential impacts would be negligible. *(Cont'd)*	**Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.* • However, if the Mountaineer Plant provides all the water required for drilling, the demand would represent between 4 to 6 percent of the NHWF's unused capacity.	**Pipeline Corridors** *Same as Scenario A.* **Injection Well Sites** *Same as Scenario A.* • However, if the Mountaineer Plant provides all the water required for drilling, the demand would represent between 5 to 9 percent of the NHWF's unused capacity.

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
	Utilities *(Cont'd)*		
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to utilities.	**Injection Well Sites** *(Cont'd)* • *Negligible.* The primary source of water for drilling has not yet been determined. If the ash pond or Ohio River are used as sources, there would be no effect on the utilities. If the Mountaineer Plant provides all the water required for drilling, the demand would represent between 2 to 4 percent of the NHWF's unused capacity. Electricity would be supplied from the closest appropriate source and impacts would be negligible.		.
	OPERATIONS **CO_2 Capture Facility** • *Minor.* An increased labor force would raise potable water consumption by 2,166 gpd, which represents 0.7 percent of the unused capacity of the NHWF. Increased sanitary wastewater generation would consume 0.9 percent of the unused capacity of the NHSWF. • *Negligible.* Increased daily demand for process water and electricity would be satisfied by the existing Mountaineer river water loop and Mountaineer Plant, respectively, and would not affect local utilities. **Pipeline Corridors** • *Negligible.* The pipeline corridors would have no independent operational utility demands and would not affect local utilities.	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* . **Pipeline Corridors** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility** *Same as Scenario A.* . **Pipeline Corridors** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Utilities *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to utilities.	**Injection Well Sites** • *Negligible.* Injection well sites would have no independent operational demand for potable water, process water, or wastewater treatment. If electricity is provided through the impact to construction material resources and suppliers it would be negligible. • *Negligible to Minor.* If electricity at the injection well sites is provided by AEP it would have a negligible impact . If connection to public electrical utilities would occur, potential impacts are expected to be minor.	**Injection Well Sites** *Same as Scenario A.*	**Injection Well Sites** *Same as Scenario A.*
Community Services			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to community services.	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible.* The construction of the Mountaineer CCS II Project would not displace any community services, impact any law enforcement, fire protection, and emergency service access, or conflict with local and regional plans for community services. • *Negligible to Minor*. The temporary increase in construction workers would have a short-term negligible to minor impact on community facilities and services.	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Community Services *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to community services.	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible.* The operation of the Mountaineer CCS II Project would not displace any community services, impact any law enforcement, fire protection, and emergency service access, or conflict with local and regional plans for community services. • *Negligible to Minor.* Once operational, the Mountaineer CCS II Project could result in an increase in population of approximately 95 residents. This increase would have a negligible to minor impact on community services as it represents only a 0.04 percent increase in population.	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*
Socioeconomics			
	CONSTRUCTION **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible to Minor*. Some construction workers hired for the project would be expected to commute to the construction site on a daily basis, while others would relocate to the area for the duration of the construction period. Therefore, a negligible to minor increase in population may occur. • *Beneficial*. The minor temporary increase in population would increase local housing demand commensurately, and would have a minor beneficial short-term impact on the ROI's housing market. *(Cont'd)*	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**CONSTRUCTION** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Socioeconomics *(Cont'd)*			
	CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites *(Cont'd)* • *Beneficial.* There would be moderate, short-term beneficial impact to economy and employment within the ROI from construction of the Mountaineer CCS II Project. • *Beneficial.* There would be a moderate, short-term beneficial impact to taxes and revenue within the ROI from construction of the Mountaineer CCS II Project		
	OPERATIONS **Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible to Minor.* There would be a negligible to minor impact to population and housing from operation of the Mountaineer CCS II Project . • The project would require an increase in staff of approximately 38 full-time employees. It is anticipated that many of these workers would be drawn from the regional labor pool and already reside within the ROI. • *Beneficial.* The operational phase of the project would have annual operation and maintenance needs that would benefit the ROI. The operational phase of the project would also have a direct and beneficial impact on employment by creating 38 permanent jobs in the ROI.	**OPERATIONS** **Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**OPERATIONS** **Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Socioeconomics *(Cont'd)*			
	• *Negligible to Minor.* Once operational, the project could result in an increase in population of approximately 95 residents. This increase would have a negligible to minor impact on community services as it represents only a 0.04 percent increase in population. • *Negligible*. There would be a negligible, long-term impact to taxes and revenue within the ROI from operation of the project.		
Environmental Justice			
<u>CONSTRUCTION AND OPERATIONS</u> *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to environmental justice.	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible*. There are no areas of minority population located within the ROI. Therefore, no disproportionately high and adverse impacts to minority populations are anticipated during construction. • *Beneficial.* Although there are low-income individuals living within the ROI, the percentage of low-income individuals living within Census Tract 954800 is lower than both the remainder of Mason County and the state. Therefore, no disproportionately high and adverse impacts to low-income populations are anticipated. Potential impacts would be temporary in nature. Conversely, short-term beneficial impacts may include an increase in employment opportunities and potentially higher wages or supplemental income through jobs created during construction of the Mountaineer CCS II Project.	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**<u>CONSTRUCTION</u>** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

Table 4.1-2. Summary Comparison of Unavoidable Impacts of the Mountaineer CCS II Project

No Action Alternative	Scenario A *(Lower Bound)*	Scenario B	Scenario C *(Upper Bound)*
Environmental Justice *(Cont'd)*			
CONSTRUCTION AND OPERATIONS *None.* The Mountaineer Plant property, pipeline corridors, and injection well properties would remain in their existing states and there would be no changes to environmental justice.	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** • *Negligible.* There are no areas of minority population located within the ROI. Therefore, no disproportionately high and adverse impacts to minority populations are anticipated during operation. • *Beneficial.* Although there are low-income individuals living within the ROI, the percentage of low-income individuals living within Census Tract 954800 is lower than both the remainder of Mason County and the state. Therefore, no disproportionately high and adverse impacts to low-income populations are anticipated. In addition, a minor long-term beneficial impact to low-income populations would include an increase in employment opportunities and potentially higher wages or supplemental income through jobs created during operation (i.e., up to 38 jobs) of the Mountaineer CCS II Project.	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*	**OPERATIONS** **CO_2 Capture Facility, Pipeline Corridors, and Injection Well Sites** *Same as Scenario A.*

AEP = American Electric Power Service Corporation; APE = Area of Potential Effect; BMP = best management practice; C&D = construction & demolition; CAP = chilled ammonia process; CO = carbon monoxide; CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; dBA = A-weighted decibel; DOE = U.S. Department of Energy; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; gpd = gallons per day; HEL = highly erodible land; HUD = U.S. Department of Housing and Urban Development; mgd= million gallons per day; L_{eq} = continuous equivalent sound level; LOS = level of service; MBTA = Migratory Bird Treaty Act; NH_3 = ammonia; NHSWF = New Haven Sanitary Waste Facility; NHWF = New Haven Water Facility; NO_x = nitrogen oxides; NPDES = National Pollutant Discharge Elimination System; PHEL = potentially highly erodible land; PM_{10} = particulate matter of diameter 10 microns or less; $PM_{2.5}$ = particulate matter of diameter 2.5 microns or less; ppmv = parts per million by volume; ROI = region of influence; ROW = right-of-way; SO_2 = sulfur dioxide; SO_3 = sulfur trioxide; tpy = tons per year; UIC = Underground Injection Control; USFWS = U.S. Fish and Wildlife Service; VOC = volatile organic compound; WWTP = wastewater treatment plant; E = east; SSW = south, southwest; NW = northwest; SE = southeast; W = west

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4.2 POTENTIAL CUMULATIVE IMPACTS

4.2.1 Background and Requirements

This section analyzes potential cumulative impacts of the proposed project. Cumulative impacts include the potential environmental impacts from other existing or proposed actions that, in combination with potential environmental impacts from the Mountaineer CCS II Project, could result in collectively significant (i.e., cumulative) effects. The CEQ defines "cumulative impact" in regulations implementing the procedural provisions of NEPA (40 CFR 1508.7) as, *"…the impact on the environment which results from the incremental impact of the [proposed] action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."* CEQ has provided guidance to NEPA analysts conducting cumulative impacts analyses within "*Considering Cumulative Effects under the National Environmental Policy Act*" (CEQ, 1997b).

Cumulative effects analysis captures the impacts that result from a project in combination with the effects of other actions taken during the duration of the project in the same ROI (i.e., at the same time and place). Cumulative effects may be accrued over time or in conjunction with other pre-existing effects from multiple activities in an area (40 CFR 1508.25); therefore, pre-existing impacts and multiple smaller impacts should also be considered. Overall, assessing cumulative effects involves defining the scope of the other actions and their interrelationship with the project to determine if they overlap in space and time. Because of the extensive influences of multiple forces, cumulative effects are the most difficult to analyze.

The NEPA, CEQ, and DOE NEPA regulations require the analysis of cumulative environmental effects of a Proposed Action on resources that may often be manifested only at the cumulative level, such as traffic congestion, air quality, noise, biological resources, cultural resources, socioeconomic conditions, utility system capacities, and others. Cumulative effects can result from individually minor, but collectively significant actions taking place at the same time and place, over time. Therefore, this cumulative effects analysis must determine if the project has the potential to result in either significant adverse or beneficial incremental impacts when considering other past, present, and future actions in the ROI.

An inherent aspect of the cumulative impacts analysis is the uncertainty surrounding future proposed actions within the Proposed Action's ROI. Most of these future proposed actions are not yet fully developed, lack supporting environmental investigations, or may not have been publicly announced. Consequently, the analysis contained in this section focuses on what could be reasonably anticipated based on available data. In addition, this analysis relies on past trends within the ROI that establish a reasonable baseline and anticipated future trajectory of proposed activities within the ROI. As many of the future proposed activities lack detailed environmental investigation data (i.e., necessary to fully identify cause-and-effect linkages to the Proposed Action), this analysis presents a reasonable, good faith effort to identify such actions, their potential effects, and the inter-relationships with the Proposed Action. These include both environmental linkages and the indirect effects related to the long-term operation of the Mountaineer CCS II Project.

Because impacts could accumulate in one or more specific resource areas, the analysis of impacts must focus on particular resources or impact areas, as opposed to merely aggregating all of the actions occurring in the ROI and attempting to form some conclusions regarding the cumulative effects of the many unrelated impacts. On this basis, the analysis of cumulative environmental impacts in this section emphasizes the resource areas for which the combination of impacts from the project and impacts from one or more other actions would potentially result in greater adverse impacts than in the case of each action separately (i.e., synergistic effects). Other resource areas, which would not experience substantially greater impacts from the combination of the Mountaineer CCS II Project and one or more other actions, receive less emphasis in this analysis, as appropriate.

4.2.2 Approach

When analyzing cumulative effects, it is paramount to establish spatial and temporal parameters for the analysis (CEQ, 1997b). ROIs for each resource area have been identified in Chapter 3. The DOE established these ROIs based on the potential for direct, indirect, and cumulative effects of the project to manifest, considering both the context and intensity of each effect (40 CFR 1508.27).

The largest of these geographically defined ROIs (see Section 3.17, Socioeconomics) included the seven-county area surrounding the location of the project. This seven-county area includes Mason County, West Virginia (in which the project would be located) as well as immediately contiguous counties. These include Cabell, Putnam, and Jackson Counties in West Virginia, and Meigs and Gallia Counties in Ohio (see Figure 4.2-1). ROIs for other technical resource areas generally lie within this larger ROI. It is noted that the ROI for global climate change, for example, extends well beyond this boundary, and is discussed accordingly within this section.

Various factors influence the resource-specific spatial boundary, or ROI, of potential cumulative effects. For example, potential cumulative impacts to vegetation and archeological resources would be limited generally to the locations of anticipated construction and their immediate vicinities (e.g., the viewshed around historic properties). Cumulative visual and noise impacts would be limited generally to line-of-sight and hearing range from the project. In contrast, cumulative impacts from air emissions may extend miles beyond the project sites, as could impacts from discharges to a stream or river. The potential effects of GHG emissions would be global. The ROI shown in Figure 4.2-1 has been carefully established to capture those geographic areas most likely to experience meaningful and tangible (i.e., significant) cumulative effects, fully recognizing that less intense effects may occur beyond those boundaries. This clear definition is in accordance with the guidance provided by the CEQ (CEQ, 1997b). This “framing” is a necessary step to spatially bound the cumulative impact analysis, as directed by CEQ (CEQ, 1997b).

From a temporal perspective, the majority of the project’s effects would be associated with the proposed 32-month construction period, extending from approximately January 2013 to August 2015. However, effects would also be associated with operation of the project over its anticipated 20-year life. As shown throughout Chapter 3, the potential effects of the project on each resource area would vary from short to long term. Relying on that project-specific effects’ analysis and the temporal requirements of the project, this cumulative impacts analysis focuses on both the short term (32-month construction period) and the long term (20-year operation period) of the project to identify potential significant cumulative effects.

Past and present projects and activities within the ROI are effectively captured within the description of the affected environment of each resource area in Chapter 3. That affected environment discussion identified existing trends in resource conditions, such as population growth, other geologic resource effects (from past and ongoing mining operations), fragmentation of habitats, and the like within the ROI.

For the purposes of conducting a meaningful cumulative effects analysis, the DOE included and analyzed future proposed actions in the ROI based on their location (i.e., proximity to the project), their potential to result in environmental effects to each resource area based on the project’s ROI for each resource area, and the timeframe in which they are planned. The DOE identified these future proposed actions through scoping; conversations with regulatory agencies, local municipal and county governments, and county economic development organizations; reviews of published and on-line resources, including local policies, land use plans, and other plans from agencies at various levels of government; reviews of published media accounts; conversations with private organizations; and other data available from reliable internet sources.

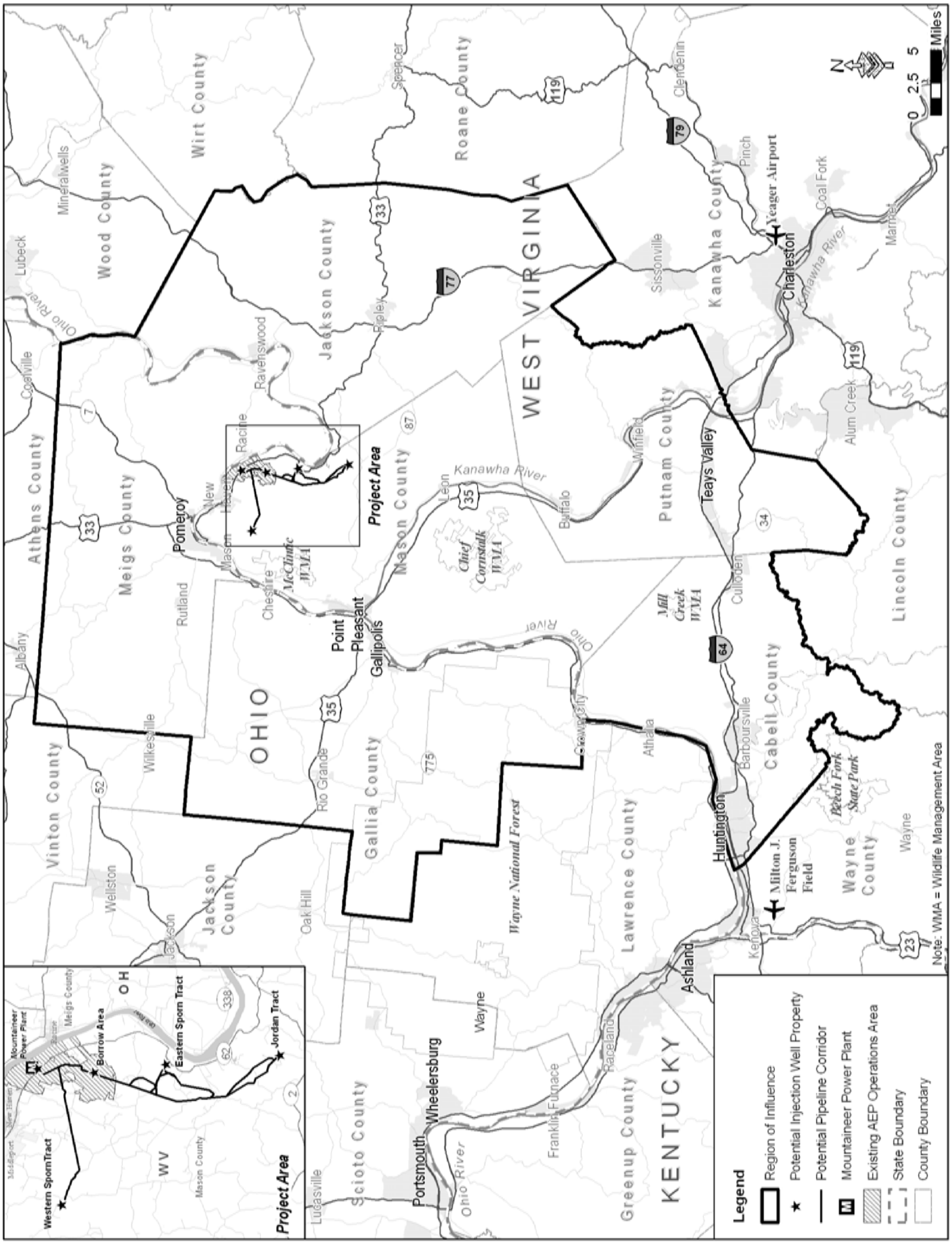

Figure 4.2-1. Region of Influence for Cumulative Impacts

In addition, the DOE equally considered past resource area trends, as these trends typically closely correlate with possible future changes and conditions. The potential impacts of the project's resultant reduction in existing GHG emissions are addressed from a regional and global perspective. This is important, as one of the primary purposes of the project would be designed to effectively demonstrate technologies to reduce air emissions, notably GHGs, to the environment.

Within the defined ROI for cumulative impacts, the DOE identified future proposed actions that could have impacts coinciding in time and space with those of the project. Descriptions of these actions are provided in Table 4.2-1. As shown in Table 4.2-1, planned future actions within the ROI generally include additional mining and energy production facilities, as well as infrastructure improvement projects. These proposed future actions are entirely consistent with the historic trends within the ROI; that is, a trend of past, ongoing, and proposed future mining and energy production activities, as well as various infrastructure improvements to improve the quality of life of the ROI's residents.

4.2.3 Cumulative Impacts by Resource Area

4.2.3.1 Introduction

This section analyzes the potential for collectively significant cumulative impacts on specific resource areas from the project in combination with the actions listed in Table 4.2-1. Concurrently, the below analyses identify resource areas for which such cumulative impacts are not anticipated, and provide the basis for such a determination. As further described below, significant (beneficial) cumulative effects on air quality and GHG emissions are anticipated through implementation of the project in conjunction with other DOE-sponsored actions in the U.S. over the long term, including broader scale implementation of this CO_2 sequestration process. Also as described below, potential short-term moderate cumulative traffic impacts on State Route 62 (i.e., during the 32-month construction period) and long-term moderate cumulative noise effects (i.e., during operation of the proposed CO_2 capture facility at the Mountaineer Plant) may occur; however, mitigation measures and BMPs proposed in this EIS would reduce these effects to the extent possible. No significant cumulative effects are anticipated to any other resource area analyzed within this EIS.

4.2.3.2 Air Quality and Climate

Construction and operation of the project in combination with the ongoing and potential future proposed actions listed in Table 4.2.1 would result in changes to air emissions within the ROI. During the 32-month construction phase of the project, air emissions from the involved sites would increase over the short term. However, over the long term, the project annually would remove approximately 1.5 million metric tons of GHGs that would otherwise be emitted to the atmosphere.

Air emissions within the ROI are regulated by the States of Ohio and West Virginia, in accordance with the SIP for each state. Through ongoing permitting and monitoring under applicable air quality regulatory programs and authorities, these cumulative actions are anticipated to have a negligible cumulative impact on air quality in the ROI. This cumulative effect would be further reduced through implementation of the project, as the project would reduce emissions from the existing Mountaineer Plant. Given the magnitude of this proposed reduction, a net beneficial cumulative air quality effect within the ROI would be expected. Further, with ongoing implementation of similar DOE sponsored actions in the U.S., a significant long-term cumulative beneficial air quality effect would be anticipated on a national scale.

Table 4.2-1. Regional Projects Identified for Consideration in the Cumulative Impacts Analysis

Site	Location	Distance (miles)	Status	Description	Additional Information
Yellowbush Coal Mine	Meigs County, OH	1.5	Active; Potential Future Expansion	Yellowbush Coal Mine is located in Meigs County, Ohio and operated by Gatling Ohio LLC. In January 2009, the USACE issued a Section 404 permit for the Yellowbush Mine docking facility (Meigs Point Dock) on the Ohio River. Yellowbush mine is on the ODNR Pending Coal Application list (7/31/10).	http://www.dnr.state.oh.us/Portals/11/mining/pdf/pending.pdf (ODNR, 2010b)
Green Global, LLC	New Haven, WV	0	Ongoing; Permit to Construct (R13-2845) Issued from WVDEP - July 2010	Mining and quarrying of non-metallic minerals. Green Global, LLC constructed and operates a portable crushing and screening plant using water-based gravity separation to recover manganese slag.	http://www.dep.wv.gov/daq/Documents/August%2013,%202010/Eval%202845.pdf (WVDEP, 2010e) http://www.dep.wv.gov/daq/Documents/August%2013,%202010/2845.pdf (WVDEP, 2010f)
AEP Mountaineer CCS II Geologic Characterization Study	New Haven, WV	0	Ongoing; Scheduled to be completed by June 2011	As part of the characterization studies, AEP plans to initially install geologic characterization wells at the Borrow Area and the Jordan Tract in order to collect data of both caprock and target injection formations. If sufficient data is not obtained from these wells to determine injection well placement and design parameters, then additional characterization wells could be installed at one or more of the remaining injection well properties.	See Section 2.3.5.1
AEP Mountaineer CCS II PVF	New Haven, WV	0	Ongoing; To be decommissioned before project is brought online	Ongoing small-scale PVF at the existing Mountaineer Plant. With implementation of the project, the PVF would be decommissioned with long-term monitoring conducted as part of the overall project and in accordance with the WVDEP UIC permit.	See Section 2.3.3.1
Broad Run Coal Mine	New Haven, WV	0	Potential Closure	Broad Run Coal Mine continues to remain inactive after April 2010 layoffs, and may be closed in the future. Current operations include at least one MMU. The underground mine is operated by Big River Mining.	

Table 4.2-1. Potential Actions Identified for Consideration in the Cumulative Impacts Analysis (Continued)

Site	Location	Distance (miles)	Status	Description	Additional Information
American Municipal Power	Letart Falls, OH (Meigs County)	5	Potential Future	Proposed 600-MW natural gas power plant announced on August 19, 2010. No natural gas pipelines in the area. Same location as cancelled 1,000-MW coal power plant. Proposed to be operational by 2014.	http://www.meigscountyohio.com/cgi-bin/NewsScript/newsscript.pl?record=4 (Meigs County Economic Development Office, 2010)
Byrd Dam	Gallipolis, OH (Gallia County)	18	Potential Future	Proposed 48-MW hydroelectric power plant. FERC license application may be submitted in 2010. The application approval process can take 2 years or more.	
Mason County Airport Runway	Mason County, WV	9	Ongoing Construction	$2 million FAA grant for redevelopment of runway. The Mason County Development Authority identified this project as currently underway.	
Armstrong Mineral Wool Plant	Jackson County, WV	15	Ongoing Construction	Armstrong World Industries is constructing an environmentally friendly mineral wool plant on 35 acres in the Jackson County Industrial Center in Millwood, WV.	http://www.jacksonwvassessor.com/ (Thomas, 2010) http://www.jacksonnewspapers.com/news/x294028130/Armstrong-plant-will-employ-45-provide-200-construction-jobs (Jackson County Newspapers, 2010).
U.S. Route 35	Putnam County, WV	30	Ongoing Construction	Approximately 14 miles of U.S. Route 35 remains to be constructed. When complete, this road will extend 35 miles from Crooked Creek (Putnam Co.) to Point Pleasant (Mason Co.).	http://planning.putnamcounty.org/infrastructure.htm (Mellert, 2010) http://www.transportation.wv.gov/communications/Press-Release/Pages/EightAdditionalMilesofRoute35toOpenToTraffic.aspx (WVDOT, 2010a) http://www.wsaz.com/political/newsreleasesheadlines/30806214.html (WSAZ News Channel 3, 2008)
Kenna Ridge Business Park	Jackson County, WV	21	Ongoing Construction	New business park on 64 acres in Kenna, WV.	http://jcda.org/Kenna_Ridge_Business_Park.html (Kenna Ridge Business Park, 2010)

Proposed Sewer Improvements	Leon and New Haven, WV; Gallia County, OH	0-60	Ongoing Construction/Potential Future	Various local sewer improvement projects within the ROI. Potential cumulative beneficial effect to groundwater and surface water.	http://www.epa.state.oh.us/LinkClick.aspx?fileticket=VqY6zYpXuMA%3D&tabid=2202 (OEPA, 2009) http://www.mydailyregister.com/view/full_story/2024430/article-Plans-progress-for-New-Haven-sewer-project? (Fields, 2009)
Proposed Road Improvements	Gallia County, OH; Mason County, WV	15-20	Ongoing Construction/Planned	Various local WVDOT and ODOT road improvement projects, including widening of existing roads. Potential cumulative beneficial effect to transportation and traffic.	http://www.dot.state.oh.us/projects/Pages/default.aspx (Ohio Department of Transportation, 2010) http://www.transportation.wv.gov/communications/Highways-Projects/US_35/Pages/default.aspx (WVDOT, 2010b)

FAA = Federal Aviation Administration; MMU = mobile mining unit; MW = megawatt; ODNR = Ohio Department of Nature Resources; ODOT = Ohio Department of Transportation; OH = Ohio; PVF = product validation facility; ROI = region of influence; UIC = Underground Injection Control; U.S. = United States; USACE = U.S. Army Corps of Engineers; WV = West Virginia; WVDEP = West Virginia Department of Environmental Protection; WVDOT = West Virginia Department of Transportation

4.2.3.3 Greenhouse Gases

Impacts of Greenhouse Gases on Climate

Climate is usually defined as the "average weather" of a region, or more scientifically as the statistical description of a region's weather in terms of the means and variability of relevant parameters over periods ranging from months to thousands of years. The relevant parameters include temperature, precipitation, wind speed and direction, and dates of meteorological events such as first and last frosts, beginning and end of rainy seasons, and appearance and disappearance of pack ice. Greenhouse gases in the atmosphere absorb energy that would otherwise radiate into space, increasing the possibility that anthropogenic (human-caused) releases of these gases could result in warming that might eventually alter climate (IPCC, 2007). Potential impacts of GHGs on climate are essentially cumulative impacts, because no single source of GHG emissions is substantial enough to affect climate independently.

Changes in climate are difficult to detect because of the complex variability in natural meteorological patterns over long periods of time and across broad geographical regions. There is much uncertainty regarding the extent of global warming caused by anthropogenic GHGs, the climate changes this warming will produce, and the appropriate strategies for stabilizing the concentrations of GHGs in the atmosphere. The World Meteorological Organization and United Nations Environment Programme established the IPCC to provide an objective source of information about global warming and climate change. The IPCC's reports are generally considered an authoritative source of information on these issues.

According to the IPCC Fourth Assessment Report, "*Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level*" (IPCC, 2007). The IPCC report found that the global average surface temperature has increased by about 1.3°F in the last 100 years; global average sea level has risen about 6 inches over the same period; and cold days, cold nights, and frosts over most land areas have become less frequent during the past 50 years. The report concluded that most of the temperature increase since the middle of the 20th century "*is very likely due to the observed increase in anthropogenic [GHG] concentrations*."

The 2007 report estimated that, at present, CO_2 accounts for about 77 percent of the global warming potential attributable to anthropogenic releases of GHGs, with the vast majority (74 percent) of this CO_2 coming from the combustion of fossil fuels. Although the report considers a wide range of future scenarios regarding GHG emissions, CO_2 would continue to contribute more than 70 percent of the total warming potential under all of the scenarios. The IPCC therefore believes that further warming is inevitable, but that this warming and its effects on climate could be mitigated by stabilizing the atmosphere's concentration of CO_2 through the use of (1) "low-carbon technologies" for power production and industrial processes; (2) more efficient use of energy; and (3) management of terrestrial ecosystems to capture atmospheric CO_2 (IPCC, 2007).

Environmental Impacts of Climate Change

The IPCC and the USGCRP, formerly the U.S. Climate Change Science Program, have examined the potential environmental impacts of climate change at global, national, and regional scales. The IPCC report states that, in addition to increases in global surface temperatures, the impacts of climate change on the global environment may include

- more frequent heat waves, droughts, and fires;
- rising sea levels and coastal flooding;
- melting glaciers, ice caps, and polar ice sheets;
- more severe hurricane activity and increases in frequency and intensity of severe precipitation;
- spread of infectious diseases to new regions;

- loss of wildlife habitats; and
- heart and respiratory ailments from higher concentrations of ground-level ozone (IPCC, 2007).

On a national scale, average surface temperatures in the U.S. have increased, with the last decade being the warmest in more than a century of direct observations (CCSP, 2008). Potential impacts on the environment attributed to climate change observed in North America include

- extended periods of high fire risk and large increases in burned area;
- increased intensity, duration, and frequency of heat waves;
- decreased snow pack, increased winter and early spring flooding potentials, and reduced summer stream flows in the western mountains; and
- increased stress on biological communities and habitat in coastal areas (IPCC, 2007).

The USGCRP recently reported the following impacts and trends in the northeast region of the U.S., including West Virginia, associated with climate change (USGCRP, 2009):

- Extreme heat and declining air quality are likely to pose increasing problems for human health, especially in urban areas.
- Agricultural production is likely to be adversely affected as favorable climates shift.
- Projected reduction in snow cover will adversely affect winter recreation and industries that rely upon it.

Addressing Climate Change

Concern regarding the relationship between GHG emissions from anthropogenic sources and changes to climate has led to a variety of federal, state, and regional initiatives and programs aimed at reducing or controlling GHG emissions from human activities as discussed in Section 3.2, Greenhouse Gases. It is generally accepted that any successful strategy to address GHG reductions would require a global approach to controlling these emissions.

Because climate change is considered a cumulative global phenomenon, it is generally accepted that any successful strategy to address climate change must rest on a global approach to controlling these emissions. In other words, imposing controls on one industry or in one country is unlikely to be an effective strategy. In addition, because GHGs remain in the atmosphere for a long time, and industrial societies will continue to use fossil fuels for at least the next 25 to 50 years, climate change cannot be avoided. As the IPCC report states: "*Societies can respond to climate change by adapting to its impacts and by reducing [GHG] emissions (mitigation), thereby reducing the rate and magnitude of change*" (IPCC, 2007).

According to the IPCC, there is a wide array of adaptation options. While adaptation will be an important aspect of reducing societies' vulnerability to the impacts of climate change over the next two to three decades, "*adaptation alone is not expected to cope with all the projected effects of climate change, especially not over the long term as most impacts increase in magnitude*" (IPCC, 2007). Therefore, it will also be necessary to mitigate climate change by stabilizing the concentrations of GHGs in the atmosphere. Because these gases remain in the atmosphere for long periods of time, stabilizing their atmospheric concentrations will require societies to reduce their annual emissions. The stabilization concentration of a particular GHG is determined by the date that annual emissions of the gas start to decrease, the rate of decrease, and the persistence of the gas in the atmosphere. The IPCC report predicts the magnitude of climate change impacts for a range of scenarios based on different stabilization levels of GHGs. "*Responding to climate change involves an iterative risk management process that includes both* *mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity, and attitudes to risk*" (IPCC, 2007).

Climate Change, Greenhouse Gases, and the Proposed Mountaineer CCS II Project

The capture and geological storage of existing GHG emissions by the project would produce a beneficial cumulative effect on a national and global scale. As discussed in this section, the project would remove approximately 1.5 million metric tpy of CO_2 that would otherwise be emitted to the atmosphere. With this project, AEP would reduce CO_2 emissions from the Mountaineer Plant from approximately 8.5 million metric tpy to approximately 7 million metric tpy.

These reductions in emissions alone, however, would not appreciably reduce global concentrations of GHG emissions. However, these emissions changes would incrementally affect (reduce) the atmosphere's concentration of GHGs, and, in combination with past and future emissions from all other sources, contribute incrementally to future change in atmospheric concentrations of GHGs. At present there is no methodology that would allow DOE to estimate the specific effects (if any) this increment of change would produce near the project area or elsewhere.

Climate Change, Greenhouse Gases, and the DOE CCPI Financial Assistance

As described in more detail in Section 1.2, the DOE selected the project for further, more detailed consideration for financial assistance. The project would serve the DOE's CCPI Round 3 objective to demonstrate advanced coal-based technologies that capture and sequester CO_2 emissions. DOE believes that accelerated commercial use of new or improved technologies will help sustain economic growth, yield environmental benefits, and produce a more stable and secure energy supply.

Demonstration and advancement of technologies that increase efficiency, facilitate carbon capture, and sequester CO_2 are important steps in developing strategies for controlling GHG emissions. The IPCC report states that there is "high agreement" that atmospheric concentrations can be stabilized by *"deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades assuming that appropriate and effective incentives are in place for their development."* The IPCC identifies CCS for coal-fired power plants as one of the "key mitigation technologies" for development before 2030 (IPCC, 2007). The IPCC notes that energy efficiency will also play a key role in stabilizing atmospheric concentrations of GHGs.

The DOE believes that the objectives of the CCPI cost-shared effort between the U.S. Government and industry fulfill, in part, these recommendations of the IPCC. The DOE further believes that by providing financial assistance for the project, the DOE would be providing appropriate incentives for developing technologies that can reduce GHG emissions and climate change concerns. Therefore, the project, in combination with its successful demonstration, broader scale application, and other similar DOE-sponsored GHG-reducing initiatives in the region and across the U.S., would be expected to result in a significant long-term cumulative (beneficial) effect by reducing GHG emissions and addressing climate change concerns.

4.2.3.4 Geology

While other past, present, and planned future activities have, continue to, and would affect geological resources within the ROI (e.g., coal mining), the project would not noticeably affect similar geological resources (i.e., the same geological formation). The project generally would affect geological resources substantially deeper than any other non-AEP past, present, or planned activity within the ROI. As such, the project would not produce a cumulative effect to these more shallow geological resources.

With regard to past, present, and planned future AEP actions within the ROI, the impacts of the project combined with the impacts of the geologic characterization work (i.e., the work AEP would conduct to determine the location of the potential injection well sites) and the existing PVF injection wells would result in a minor cumulative impact to deeper geological resources. Any geological impacts resulting from constructing the characterization wells would be similar to those described for the project. If the

Mountaineer Plant is chosen to host an injection well, there is a potential for the plumes from the project and the PVF to interact with each other. Although the PVF would be decommissioned before injection would occur at the Mountaineer Plant, the proposed injection wells at the site would be within the plume radius of the PVF. The design of the existing and potential wells would ensure that the CO_2 would not degrade the well casings; a MVA program would be used to ensure that the subsurface pressure remains within safe operating levels in accordance with the UIC permit. Therefore, the potential cumulative impacts of all of AEP's existing and proposed activities relative to the Rose Run and Copper Ridge Formations within the ROI would be minor.

4.2.3.5 Physiography and Soils

Soils and physiography within the ROI have historically been altered by human activities over the last 200 years. Previous human activities, in particular farming, mining, and industrial use, have altered soil formations and numerous soil properties, including soil structure and soil fertility. Due partly to these human activities, and partly to natural, geological conditions, many of the soils within the ROI are highly erodible, and have little value for agricultural production besides forestry. More recent disturbances, such as grading in connecting with new construction, additional mining activities, and installation of utility transmission corridors, have resulted in localized, severely decreased soil quality.

The project, in combination with the ongoing and proposed future power plant, mining, and infrastructure proposed actions within the ROI listed in Table 4.2-1, as well as their possible future expansion, would result in regionally minor, generally localized cumulative effects to physiographic and soils resources. With implementation of the BMPs identified in this EIS, the effects of the project would be further minimized, resulting in a negligible cumulative effect.

4.2.3.6 Groundwater

The project would not contribute to significant cumulative effects to groundwater quality or quantity, as the project would result in only negligible effects to this resource. As described in this EIS, potable groundwater supplies within the ROI are ample to support current and future proposed development. The project, during both construction and operation, would result in a negligible increased demand on groundwater quantity; this demand would be greater during the proposed construction period when up to 800 construction workers may be present. Over the long term, the project would add up to 38 new full-time staff (and potentially their families) to the ROI, producing a negligible increased demand on groundwater resources. Coupled with proposed future activities within the ROI over the potential 20-year operational life of the project, significant cumulative effects to groundwater quantity are not anticipated.

In terms of groundwater quality, the project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, could result in minor cumulative groundwater quality impacts. Other ongoing and future activities in the ROI have a similar potential for accidental spills as those described for the project. In addition, the project could require hydraulic stimulation (see Section 3.5, Groundwater); however, such activity would not affect potable groundwater supplies within the ROI, as these activities would affect deeper regions. The aggregate of such accidental spills and effects to groundwater would not constitute a cumulatively significant impact to regional or local groundwater quality or potable water aquifer integrity. In addition, various proposed sanitary sewer improvement projects within the ROI would serve to improve groundwater quality by reducing the reliance on septic systems. Septic systems have the potential to locally degrade groundwater quality due to infiltration of waste into the aquifer. Therefore, any cumulative impacts would be negligible to minor.

4.2.3.7 Surface Water

The project would not contribute to significant cumulative effects to surface water quality or quantity, as the project would result in only negligible effects to this resource. Although the project would affect surface waters during construction (e.g., stream crossings of potential pipelines), compliance with Section

404 of the CWA and the NPDES program, including associated permitting and mitigation requirements, would reduce the likelihood of cumulative effects to negligible levels.

The ROI for potential cumulative impacts to surface waters consists of the Middle Ohio South watershed, drained by the Ohio River. Although the project would not be expected to degrade surface water quality directly, indirect impacts from the project, the development of other projects as identified in Table 4.2-1, and general development anticipated to occur within the ROI could incrementally impact surface water quality. The aggregate increase in impervious surface areas associated with this future development could increase the amount of stormwater distributed to surface water channels and could potentially increase the frequency and severity of high-flow events. The increased impervious area could also contribute to the degradation of water quality through the increase in the quantity of pollutants attributable to runoff. However, these stormwater effects, in terms of quality and quantity, of the project would be effectively mitigated through the NPDES permitting process via the WVDNR. As such, the project would not be expected to contribute to cumulative effects. Compliance with applicable local, state, and federal surface water regulations in association with other proposed future proposed actions equally would ensure the cumulative effects are maintained at acceptable levels.

Several areas of the Ohio River are currently impaired and are included on the EPA list of impaired waters (CWA Section 303(d)) due to dioxin, bacteria, and iron. The project would not contribute additional amounts of these constituents to the Ohio River. Some water quality issues impacting the Ohio River include nonpoint source pollution from urban runoff, agricultural activities, and abandoned mines. Studies have pinpointed elevated levels of bacteria from such sources as combined sewer overflows. A cumulative increase in impervious areas could contribute more nonpoint source pollution to the Ohio River. Ongoing improvements within the ROI to sewer infrastructure would serve to decrease these adverse effects. Therefore, cumulative impacts of the project on surface water quality would be negligible.

Water quality could also be affected by potential hazardous material spills from the project and other ongoing and future proposed actions within the ROI. As the number of roadway travel lanes, traffic volume, and the density of development increase within the ROI, the risk of spills could increase. An accidental spill of a large quantity of a hazardous material could affect surface waters if the spill was not immediately contained and cleaned up. However, the project would only negligibly contribute to this potential cumulative effect, as BMPs incorporated into the project would minimize this potential.

4.2.3.8 Wetlands and Floodplains

Past human development in the ROI has resulted in considerable amounts of development within wetlands and floodplains. In particular, previous development along the Ohio River, such as New Haven, Hartford, and the Mountaineer Plant itself, have altered flood flow characteristics of the Ohio River floodplain. These historic changes in the ROI have generally resulted in higher flood elevations in upstream portions of the floodplain. In addition, past development near the banks of the Ohio River has resulted in the filling of considerable amounts of wetlands; palustrine wetlands are typically more prevalent along the river than inland. Past, generally more limited, inland development within the ROI has resulted in filling of wetlands; Riverine wetlands are typically more prevalent than Palustrine wetlands within inland areas.

The Yellowbush Coal Mine proposes to construct a docking facility in Meigs County along the Ohio River. Development of this facility could result in the redirection of flood flows and could require filling of wetlands. The other future proposed actions identified in Table 4.2-1 could result in additional incremental effects to wetlands and floodplains in the ROI. However, each proposed action, like the Mountaineer CCS II Project, would be required to comply with Section 404 of the CWA, NPDES permitting requirements, and other applicable local, state, and federal regulations affording protection to wetlands and floodplains. Compliance with these requirements, including oversight by pertinent regulatory agencies tasked with the stewardship of these resources, would ensure cumulative effects are maintained at acceptable levels.

The AEP Mountaineer CCS II Geologic Characterization Study would not be expected to cause filling of wetlands or adverse effects to floodplains because AEP's well siting criteria preclude this from occurring. In addition, no mapped 100-year floodplain areas are located within the Borrow Area or the Jordan Tract where the study will occur. The project itself would negligibly affect wetlands and floodplains within the ROI as described in this EIS. All such effects would be very localized, limited, and controlled through the permitting process, ensuring no net loss of these resources and maintenance of the quality of these resources during both the proposed construction and operation phases. Overall, the project would contribute negligibly to cumulative wetland and floodplain effects within the ROI.

4.2.3.9 Biological Resources

Previous human activities, primarily including industrial, mining, energy production, utility transmission, residential, and agricultural development, have produced major past and ongoing effects to biological resources within the ROI. These activities have led to a regional decline of historical ecosystems and conversion of once forested ecosystems into human-altered landscapes (e.g., row crops, pasture land, developed space, transmission ROWs, etc.). These activities have also contributed to a decline in the extent and quality of aquatic habitats (i.e., increased sedimentation and nutrients in surface waters, increased stream temperatures, and decreased dissolved oxygen). In addition, past actions, including roadway construction and placement of utility transmission lines have caused fragmentation of once contiguous forested habitat.

The project, in combination with the ongoing and proposed future power plant, mining, and infrastructure proposed actions within the ROI listed in Table 4.2-1, as well as their possible future expansion, would result in regionally minor, generally localized cumulative effects to biological resources. The project, notably due to construction and maintenance of the pipeline corridors and injection well sites, would contribute to both short- and long-term removal of vegetative cover, localized reduction in wildlife habitat, and additional fragmentation of habitat. With implementation of the BMPs identified in this EIS, however, the effects of the project would be further minimized, and would not contribute to a significant cumulative impact to biological resources within the ROI.

4.2.3.10 Cultural Resources

The project would not contribute to significant cumulative effects to cultural resources within the ROI, as the project would result in only negligible effects (and likely no effects) to such resources. As described in this EIS, the DOE conducted extensive surveys and found no potential for adverse effects to cultural resources protected under Section 106 of the NHPA.

4.2.3.11 Land Use and Aesthetics

The project would not contribute to significant cumulative effects to land use or aesthetics within the ROI, as the project would result in only negligible (or no) effects to such resources. Since Mason County does not have a planning commission to oversee and manage land development and land use in areas lying outside of municipalities, land use within this portion of the ROI has occurred without any planning or zoning constraints. Previous and current land use activities in the region have primarily included industrial development, agriculture, and mining. A small number of rural residential properties are also present in the ROI. In addition, roadways have been constructed and utility transmission lines have been installed. This prior development has caused fragmentation of once contiguous parcels of land, and has led to the current mixed-use land development pattern characteristic of the ROI today.

Overall, the project is generally consistent with local land use and would not dramatically alter the aesthetics of the ROI. Aboveground components of the project would be limited to changes in vegetation along potential pipeline corridors and injection well sites, installation of minor equipment at the relatively isolated injection well sites, and the addition of infrastructure at the developed Mountaineer Plant. The project, in combination with the ongoing and proposed future power plant, mining, and infrastructure proposed actions within the ROI listed in Table 4.2-1, as well as their possible future expansion, would result in minor, generally localized cumulative effects to land use and aesthetics.

4.2.3.12 Traffic and Transportation

The project would not contribute to long-term significant cumulative effects to transportation and traffic within the ROI, as the project would result in only negligible long-term effects to such resources. As identified in Section 3.11, Traffic and Transportation, the project would result in project-specific, moderate short-term traffic effects due to construction traffic in the vicinity of the proposed project sites, and most notably on State Route 62. Implementation of BMPs and mitigation measures identified in this EIS would serve to reduce these short-term effects during the proposed 32-month construction period to the extent possible.

During the anticipated 20-year operation of the project, it is expected that State Route 62 would be able to handle the cumulative traffic requirements of all current and future proposed actions within the ROI, including the project. Long-term traffic and transportation effects of the project, as described in this EIS, would be negligible. As shown in Table 4.2-1, the DOE identified no major proposed developments that would place additional, long-term, substantial demands on the involved sections of State Route 62 (i.e., Green Global LLC would result in a minor amount of long-term, operational traffic). Also as shown in Table 4.2-1, the Ohio Department of Transportation and WVDOT plan to continue roadway infrastructure upgrades within the ROI to accommodate existing and anticipated future traffic conditions. These improvements are anticipated to continue on an as-needed basis throughout the ROI, including on State Route 62 (as and when appropriate), ensuring local roadways are capable of servicing traffic demands. Therefore, the project, over the long term, would contribute negligibly to cumulative transportation and traffic effects within the ROI.

4.2.3.13 Noise

During construction, noise impacts associated with the project would be very localized and temporary, and would not contribute to a long-term cumulative increase in noise within the ROI. This ROI is generally limited to the immediate vicinity of the proposed project sites. These project-specific effects would be reduced to the extent possible as described in Section 3.12, Noise.

The project could contribute to long-term significant cumulative noise effects in the vicinity of the Mountaineer Plant. Baseline noise levels in the vicinity of the Mountaineer Plant could increase by as much as 3.6 dBA at potentially sensitive noise receptors near the existing plant (Receptors 1, 4, and 5, as demonstrated in Section 3.12.2.1). Although this change in noise level would be barely detectable, existing noise levels at these locations may already be near or above the EPA guideline threshold of L_{eq} 48.6 dBA, according to one study. However, existing noise levels were found to be within levels classified by HUD as "acceptable" for outdoor levels at residential properties (L_{eq} of 58.6 dBA). Thus, by adding additional noise to this location, a significant long-term cumulative noise impact could result (i.e., through combining existing noise levels from the Mountaineer Plant with the project). Noise mitigation measures and BMPs identified within this EIS would serve to lessen this effect to the maximum extent possible.

As shown in Table 4.2-1, no future proposed actions would occur within the very confined noise impact ROI of the project, including in the vicinity of the Mountaineer Plant. As such, no additional long-term cumulative noise impacts are expected.

4.2.3.14 Materials and Waste Management

The project would not contribute to significant cumulative materials and wastes effects within the ROI, as the project would result in only minor effects to such resources. The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, could result in slightly increased demand and thus a potential cumulative impact on suppliers of construction materials, operational materials, and waste disposal. However, most of these actions involve mineral extraction and would not be additive to the specific materials requirements of the project. Green Global LLC generates a recyclable product for the marketplace. Also, the existing ROI market capacities for implementation of these actions would not be exceeded, so the synergistic cumulative impacts would be minor.

Waste generation and offsite waste transportation and disposal would be required during the construction period. Waste generation and offsite disposal would also result from operation. The cumulative impacts are considered minor because, in combination with the other foreseeable actions, available landfill capacities within the ROI would not be exceeded. Most of the wastes generated by the project would be disposed of without using disposal capacity external to AEP. Therefore, the project's contribution to cumulative materials and wastes effects would be minor.

4.2.3.15 Human Health and Safety

The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, would not result in cumulative impacts to human health and safety because none of the other identified proposed actions present similar accident risks. None of these other actions use or produce ammonia, so there would be no cumulatively higher probabilities of an ammonia release affecting the ROI. As the PVF would be decommissioned prior to the operation of the project, no cumulative human health and safety effects related to accident risks associated with ammonia release are identified.

With regard to potential cumulative impacts to human health and safety associated with the CO_2 pipelines and injection well sites, no significant cumulative effects are anticipated. The future proposed actions that are of most relevance to this analysis are related to increased coal mining or possible oil and gas exploration, although there are no current plans for such increased or expanded activities in Mason County, West Virginia (see Table 4.2-1). The potential pipelines and injection well sites would have to be taken into consideration for future mining activities. The currently inactive Broad Run underground coal mine underlies portions of some of the pipeline corridors. Thus, future activity at the Broad Run mine (not currently proposed, closure possible; see Table 4.2-1) would need to consider the potential impact on the pipelines and the estimated extent of the CO_2 plumes below ground, depending on the injection well sites selected, when siting new shafts or air vents.

Increased activity at the Yellowbush Coal Mine in Meigs County, Ohio, or the Green Global mining operation in New Haven would not affect the proposed pipelines, injection well sites, or CO_2 plume. Equally, none of the other actions identified in Table 4.2-1 would affect these specific locations, with the exception of the AEP characterization wells. Characterization wells that are not proposed to be used as monitoring wells would be properly plugged as prescribed by UIC regulations. Therefore, no long-term cumulative human health and safety effects are anticipated.

4.2.3.16 Utilities

The project would not contribute to significant cumulative utilities effects within the ROI, as the project would result in only minor effects to such resources. The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, would result in an increased demand and thus a minor cumulative impact to all local utilities. However, the existing utility capacities within the ROI would not be exceeded during either construction or operation. Ongoing sewer (and other utility infrastructure) improvements within the ROI (see Table 4.2-1) would continue to ensure that adequate capacity remains available over the operational life of the project.

4.2.3.17 Community Services

The project would not contribute to significant cumulative community services effects within the ROI, as the project would result in only negligible effects to such resources during both the construction and operation phases. The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, would result in an increased demand and thus a minor cumulative impact to community services. Although community services needs are anticipated to increase as the ROI continues to slowly grow, community services should commensurately grow with the increasing population. Presently, services are not being strained and maintain ample capacity to service the current and projected future needs of the ROI. However, in the future, additional services or capacity may be required, depending upon the long-term growth of the ROI. Construction of the project would add only negligibly to these cumulative impacts.

4.2.3.18 Socioeconomics

The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, would result in the creation of revenue for the state, county, and local governments. In addition, these actions would have a beneficial impact on the economy, employment, and revenues in the ROI. Over the long-term, the project would add negligibly to these cumulative impacts, which generally are beneficial. Given the economic conditions of the ROI, the project's contribution to the local economy, coupled with other planned actions, would result in a cumulative beneficial effect. This beneficial effect would be most noticeable during the proposed construction period.

4.2.3.19 Environmental Justice

The project, in combination with the ongoing and future proposed actions listed in Table 4.2-1, would not be expected to disproportionately affect minority or low-income populations within the ROI. Ongoing, although conservative, development of the ROI would continue to provide increased economic opportunities to local low-income populations, thus providing a beneficial cumulative environmental justice effect. No significant cumulative environmental justice impacts would occur.

4.2.4 Cumulative Impacts of the No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the Mountaineer CCS II Project. Although AEP may still elect to construct and operate the project in the absence of DOE cost-shared funding, for the purposes of the analysis in this EIS, DOE assumed that the No Action Alternative is equivalent to a No-Build Alternative. The project would not be constructed and would not contribute to any cumulative effects within the ROI. The moderate cumulative short-term traffic and long-term noise effects (i.e., generally within the immediate vicinity of the Mountaineer Plant) would not occur. However, the beneficial cumulative local, regional, and national air quality and GHG emission effects would not occur. In addition, no contribution to cumulative beneficial effects to the ROI's socioeconomic environment or environmental justice concerns would occur.

4.3 MITIGATION MEASURES

4.3.1 Introduction

For all environmental resources, the minimization and mitigation of potential adverse impacts from project activities would be achieved through the implementation of BMPs and compliance requirements contained in facility permits and other applicable federal, state, or municipal regulations and ordinances. This section provides a consolidated summary of the minimization and mitigation measures that would be implemented for each resource area. Per established protocols, procedures, and requirements, AEP would implement BMPs and would satisfy all applicable regulatory requirements in association with the design, construction, and operation of the project. These minimization and mitigation measures are described in this EIS under each technical resource area in Chapter 3, and listed in Table 4.3-1 below, and are included as components of the project. BMPs are measures that AEP regularly implements as part of their operations, including complying with regulatory requirements.

4.3.2 Mitigation Measure Summary, by Resource Area

For each environmental resource area, the reduction of potential adverse impacts from project activities would be achieved, at least in part, through the implementation of standard methods and BMPs. As described above, these are generally required by federal, state, or municipal regulations and ordinances, as well as associated permitting processes. AEP has committed within the Cooperative Agreement with DOE to implement BMPs and complying with applicable legal requirements. Therefore, this EIS analyzed the impacts of the proposed Mountaineer CCS II Project with these BMPs in place.

If, after these BMPs and restrictions are applied, this EIS's analysis identified the potential for residual adverse impacts, additional mitigation measures are recommended and identified. Table 4.3-1 summarizes, by environmental resource area, these legal (regulatory) requirements, as well as project-specific additional mitigation measures recommended for the proposed Mountaineer CCS II Project. DOE will determine whether specific additional mitigation measures would be required for implementation of the Proposed Action, and will document these requirements and this decision-making in the ROD.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Air Quality and Climate	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, Permits, and Ordinances:** • Construct the project in compliance with the Mountaineer Plant revised air permit, which would stipulate applicable controls and practices to minimized potential emissions. • Section 3.1.12 of the existing Title V Permit for the Mountaineer Plant. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Control vehicle speeds on all roads and exposed areas. • Sweep or remove spilled material from paved surfaces. • Maintain all engines in good working order. • Remove excess soil from truck tires before traveling on public roads. **Additional Measures Identified to Further Reduce Impacts:** • Treat unpaved roads with water or surfactants to minimize dust emissions. • Stage site construction to limit the amount of land area disturbed at any given time. • Surface unpaved access roads with stone whenever appropriate. • Re-vegetate disturbed areas as soon as possible after disturbance. • Cover construction materials and stockpiled soils as feasible to reduce fugitive dust, • Cover dump trucks before traveling on public roads. • Minimize the use of diesel or gasoline generators for operating construction equipment. • Minimize idling of equipment while not in use. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, Permits, and Ordinances:** • Operate the project in compliance with the Mountaineer Plant's revised air permit, which would stipulate applicable controls and practices to minimize emissions. • Section 2.13.1, Section 4.1.1, and Section 3.1.12 of the existing Title V Permit for the Mountaineer Plant. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • Use appropriate BMPs to minimize equipment and vehicle emissions by such practices as maintaining engines according to manufacturers' specifications, minimizing idling of equipment while not in use, and minimizing as practicable the use of diesel or gasoline generators during operations.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Greenhouse Gases	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, Permits, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Use appropriate BMPs to minimize equipment and vehicle emissions by such practices as maintaining engines according to manufacturers' specifications, minimizing idling of equipment while not in use, and minimizing as practicable the use of diesel or gasoline generators for operating construction equipment. **Additional Measures Identified to Further Reduce Impacts:** • None. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, Permits, and Ordinances:** • Develop and implement an EPA-approved site-specific MVA plan for CO_2 injection wells per Subpart RR of the Mandatory Reporting of Greenhouse Gases Rule. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Use appropriate BMPs to minimize equipment and vehicle emissions by such practices as maintaining engines according to manufacturers' specifications and minimizing idling of equipment while not in use. **Additional Measures Identified to Further Reduce Impacts:** • None.
Geology	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Obtain UIC and Well Works permits from the EPA or WVDEP, whichever has primacy. The wells would be constructed in accordance with these permits. The terms and conditions of the UIC and Well Works permits would ensure that the wells are designed to utilize the appropriate materials, monitoring equipment, and safety systems. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • Use standard pipeline construction BMPs to minimize geologic resource effects. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Obtain a UIC permit from the EPA or WVDEP that specifies operating and monitoring criteria for the CO_2 injection. The wells would be operated in accordance with the UIC Permit, which would also ensure that CO_2 is stored appropriately and that no leakage occurs. Additionally, a monitoring system during the 20-year injection process, as detailed in Section 2.3.6, would be implemented. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Physiography and Soils	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Develop and implement a WVDEP-approved SWPPP (to address erosion prevention measures, sediment control measures, permanent stormwater management, dewatering, environmental inspection and maintenance, and final stabilization) as required by the WVDEP DWWM, in accordance with the Mountaineer Plant's General NPDES Permit number WV0048500. The SWPPP would include erosion and sedimentation control measures recommended in West Virginia's Erosion and Sediment Control Best Management Practice Manual 2006. • Develop and implement an SPCC plan to prevent, control, and respond to releases of petroleum products that could potentially contaminate soils per the Oil Pollution Prevention regulation under the CWA. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Preservation of natural vegetation, where possible, to prevent soil erosion and sedimentation into adjacent water bodies or wetlands. • Stabilization of temporary access roads, haul roads, parking areas, laydown areas, material storage, and other onsite vehicle transportation routes immediately after grading. • Mechanically roughen the soil surface to create horizontal depressions on the contour, or by leaving slopes in a roughened condition by not fine-grading them. • Application of straw, hay or other suitable materials to the soil surface. • Use temporary seeding and mulching, or matting to produce a quick ground cover to reduce erosion on exposed soils that may be redisturbed or permanently stabilized at a later date. • Use permanent seeding to establish perennial vegetative cover on disturbed areas to reduce erosion and decrease sediment yield from disturbed areas and to permanently stabilize disturbed areas. **Additional Measures Identified to Further Reduce Impacts:** • The following BMPs would be employed by AEP, as necessary, to mitigate and minimize potential impacts during pipeline and well construction: ▪ Use wattles/fiber rolls to reduce and disperse runoff velocity and capture sediment. ▪ Remove topsoil and temporarily store onsite separately from other excavated material. ▪ Compact stored topsoil so that it would not erode. ▪ Return the majority of the excavated material to the excavated ditch. ▪ Replace the topsoil as the upper most soil layer following construction. ▪ Restore the site to its original grade. • The following BMPs would be employed by AEP, as necessary, to mitigate and minimize potential impacts during pipeline construction in areas of severe slopes and HEL: ▪ Avoid potential trouble areas, such as natural temporary drainage ways, unstable soils like high shrink-swell potential soils, highly erodible soils, etc. ▪ Avoid constructing roads on extremely steep slopes to prevent the potential for erosion. ▪ Avoid constructing close to streams and open waters to prevent the potential for sedimentation. ▪ Where construction access road crossings of stream cannot be avoided, use appropriate temporary improvements at stream crossings (adhering to Section 404 permit requirements). ▪ When construction of access roads on steep slopes cannot be avoided, water-bars should be built across the road at an angle. ▪ Clear as little vegetation as possible for construction, and replanting of vegetation as soon as possible in areas not permanently disturbed by construction.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Physiography and Soils (continued)	**Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Develop and implement an SPCC plan and a WVDEP-approved SWPPP to minimize operational impacts to soils. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • For permanent pipeline corridor ROWs, re-vegetate with appropriate grass mixes chosen for their value in increasing soil stability and decreasing probability of soil erosion.
Groundwater	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Develop and implement an SPCC plan during construction to minimize potential for groundwater contamination. This includes, enclosing fuel and chemical storage areas to minimize the potential for releases/spills to occur that could impact groundwater. • Comply with the UIC and Well Works permits during the construction of wells. This includes the requirement of using CO_2-resistant casings at the base of each well. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Develop and implement an SPCC plan during operations to minimize potential for groundwater contamination. • Comply with the UIC permit, which regulates CO_2 injection and storage. This includes complying with monitoring requirements as listed under the permit. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Surface Water	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Avoid, minimize, and mitigate impacts to surface waters through the CWA 404 permitting process under the regulatory purview of the USACE Huntington District; the NPDES and Section 401 Water Quality Certification permitting process via the WVDEP; Stream Activity permitting process via the WVDNR; and the CWA requirement for the development and implementation of an SPCC plan and SWPPP during construction. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Preserve natural vegetation as much as possible, but especially in critical areas such as on steep slopes and in areas adjacent to watercourses, swales, or wetlands. • Maximize use of existing roads and trails in planning site access. • Keep construction materials, debris, construction chemicals, construction staging, fueling, etc. at a safe distance from surface waters. Remove spoil, debris, piling, construction materials, and any other obstructions resulting from or used during construction following construction. **Additional Measures Identified to Further Reduce Impacts:** • The following BMPs would be employed by AEP, as necessary, to mitigate and minimize potential impacts:

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Surface Water (continued)	• Stabilize temporary access roads, haul roads, parking areas, laydown areas, material storage areas, and other onsite vehicle transportation routes with stone immediately after grading. ▪ Use temporary seeding and mulching or matting to produce a quick ground cover. ▪ Design pipeline crossings using the most direct route, construct water crossings during periods of low flow conditions, and use crossing sites that have low, stable banks, a firm stream bottom, and minimal surface runoff when possible. ▪ Where practical, consider weather and ground conditions when scheduling construction activities to minimize potential impacts to surface waters, such as erosion and the spread of contaminants that may be exacerbated by sheet flow during storm events. ▪ Use areas disturbed by past activities later in construction for staging, parking, and equipment storage. ▪ Use water conservation measures to the maximum extent practicable (e.g., efficient landscaping and recycling wastewater). ▪ For stream crossings using wet trenching, complete stream bed and bank stabilization before returning flow to the water body channel. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Develop and implement an SPCC plan and a WVDEP-approved SWPPP to minimize operational impacts to surface water resources. • The project would operate under the Mountaineer Plants existing NPDES Permit. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Wetlands and Floodplains	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Avoid, minimize, and mitigate impacts to wetlands through the CWA 404 permitting process under the regulatory purview of the USACE Huntington District; the NPDES permitting process via the WVDEP; and the CWA requirement for the development and implementation of an SPCC plan and SWPPP requirements during construction. • Wetland mitigation would follow the USACE Huntington District Compensatory Mitigation Policy for West Virginia and would be determined through coordination with USACE Huntington District **Measures Incorporated into Proposed Action to Reduce Impacts:** • If proposed injection site option ES-1 or the proposed access road to ES-2 is constructed, adjust the footprint of the well pad and/or access road to locate it outside of wetlands. • Design the CO_2 capture facility to locate the Cooling Tower and Reagent Storage structure, as well as all other facilities, outside of the designated 100-year floodplain. • Construct pipelines to minimize permanent changes in land contours that would affect floodplains. • During construction within floodplains, monitor weather conditions in anticipation of possible flooding events to ensure that workers and equipment are removed from the flood hazard area prior to the event. **Additional Measures Identified to Further Reduce Impacts:** • Avoid wetland areas within temporary construction ROWs to the extent practicable during the placement of equipment or materials. • Stockpile excavated soils in reverse order from which it was excavated (i.e., the deepest soils excavated would be stored at the top of the stockpile) during construction of pipeline corridors within wetlands. Following construction of the pipelines, backfill trenches with the deepest soils excavated first.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Wetlands and Floodplains (continued)	**Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Obtain all necessary permits and operate in compliance with all regulatory requirements to minimize potential surface water and wetland impacts. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Biological Resources	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Comply with NPDES permitting requirements and conditions, including erosion and sedimentation control measures, to minimize sedimentation to aquatic resources. Use these measures during in-stream construction activities and within locations adjacent to streams to minimize onsite and downstream impacts to aquatic habitat. • Comply with all SWPPP requirements. • Restore aquatic habitat to original grade and streambed substrate following in-stream trenching activities, as required by permits and regulation. Restore stream banks using appropriate stabilization measures and revegetate following specifications outlined in Section 404 permitting. • To meet the no "take" of native mussel species policy of the WVDNR, a mussel survey, and potentially relocation efforts, would be performed of the potential area of disturbance associated with the H-piling supports for the spud barge within the Ohio River. • To meet the no "take" requirement of the MBTA, perform migratory bird screenings prior to any land clearing activities during the migratory bird nesting season (April through July). The screenings would be performed by qualified biologists and would consist of searching the areas to be cleared for migratory bird nests and birds exhibiting nesting behaviors. Should any nests be found, avoid disturbing the nest, if practicable, or coordinate with USFWS on an appropriate course of action. In addition, train construction personnel to recognize nests and birds exhibiting nesting behaviors. Should construction crews encounter nests or other bird issues (e.g., deceased or injured birds), stop work until the concerns can be appropriately investigated. For any potential MBTA issues encountered during construction either avoid the area, if practicable, or coordinate with USFWS to determine the appropriate course of action. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Limit activities to the minimum area required to emplace project components. • Re-contour and re-seed all temporarily disturbed areas with a state-approved grass seed mixture appropriate to the area. **Additional Measures Identified to Further Reduce Impacts:** • To the extent practicable, confine disturbance to streambeds and banks to areas within the permanent ROW (only). To the extent practicable, confine construction staging areas to upland areas. Limit the temporary ROW within streams and wetlands. • Should a proposed project component need to be relocated, follow the siting criteria listed in Section 2.3.1. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Cultural Resources	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None, presuming the WVSHPO concurs with DOE's "no adverse effect" determination under Section 106 of the NHPA. **Measures Incorporated into Proposed Action to Reduce Impacts:** • In the event that monitoring wells would be sited on a portion of the injection well property that has not been surveyed by DOE, additional archaeological surveys would be conducted and archeological resources would be avoided to the extent practicable. **Additional Measures Identified to Further Reduce Impacts:** • If buried cultural materials are encountered during construction activities, work will cease in that area until appropriate review is undertaken to determine the nature and significance of the discovery. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Land Use and Aesthetics	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • For the siting of pipeline, adhere to 49 CFR 195 (Transportation of Hazardous Liquids by Pipeline) West Virginia Code Chapter 22 (Environmental Resources) and Chapter 24B (Gas Pipeline Safety). • Select pipeline ROWs to avoid, as far as practicable, areas containing private dwellings, industrial buildings, and places of public assembly per 49 CFR 195.210 (Pipeline Location). • Do not locate a pipeline within 50 feet of any private dwelling, or any industrial building or place of public assembly in which persons work, congregate, or assemble, unless it is provided with at least 12 inches of soil cover in addition to that prescribed in 49 CFR 195.248 (Cover Over Buried Pipeline). • Obtain all necessary ROWs for utility corridors per 49 CFR 195 and West Virginia Code Chapters 22 and 24B. **Measures Incorporated into Proposed Action to Reduce Impacts:** • In cases where a new pipeline corridor would bisect a property, include into the project design a suitable crossing of the pipeline, if required, to support vehicle crossings and maintain property owner access throughout the entire property. **Additional Measures Identified to Further Reduce Impacts:** • None. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • Incorporate landscaping into project design to reduce visual and audible impacts on surrounding property owners to the extent practicable.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Traffic and Transportation	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Comply with all local and WVDOT requirements for design and construction of any improvements to existing roadways. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Maintain public roadway traffic during construction. • Provide appropriate signage alerting and instructing traffic, barricades around the construction zone, and a flagger at either end of the construction zone during construction within road ROWs that require temporary lane closures. • If required, alternate traffic from each direction at regular intervals as needed along the open lane to avoid significant delays. • To the extent practicable, use trenchless construction methods across existing roads (e.g., directional boring) to avoid major traffic disruption on those roadways. • Stage construction across driveways so that vehicle access to property is maintained at all times. **Additional Measures Identified to Further Reduce Impacts:** • During peak construction periods, provide traffic guards on State Route 62 during workday start and end times to manage traffic flow to and from the site. • Encourage carpooling to limit the number of daily car trips. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Noise	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Comply with all local and state noise ordinances as applicable. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • Take noise measurements prior to construction and during initial drilling of injection and monitoring wells. Where substantial noise increases occur, use acoustic shields on equipment and implement other appropriate noise mitigation measures. • Develop and implement a blasting plan for safety purposes and notify occupants of nearby buildings, residences, agricultural areas, and other areas of public gathering sufficiently in advance of any blasting event. • Limit the noisiest construction activities (e.g., directional drilling for pipeline segments and pile driving activities if needed) to daytime hours. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Incorporate the following noise control measures into the CO_2 capture facility: locate and orient plant equipment to minimize sound emissions; provide buffer zones; enclose noise sources within buildings; and include silencers on plant vents and relief valves.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Noise (continued)	**Additional Measures Identified to Further Reduce Impacts:** • None.
Materials and Waste Management	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Transport construction materials and wastes in accordance with DOT regulations pertaining to proper packaging, labeling, and response to releases. • Manage construction materials and wastes in compliance with RCRA regulations pertaining to storage, labeling, containment, and disposal. • Develop and implement an SPCC plan per the Oil Pollution Prevention regulation under the CWA to prevent, control, and respond to releases of petroleum products. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Minimize the storage of hazardous materials at construction sites to the extent practicable, remove C&D waste materials from construction sites on a regular basis, and recycle C&D waste whenever possible. • Provide secondary containment and cover all liquid hazardous material storage areas. • Ensure qualified individuals trained to implement the construction SPCC Plan and spill kits are present at each work site during each work shift. • Include adequate valving, interlocks, safety systems (fogging, foaming, secondary containment, berms, spill prevention, instrumentation, ambient monitoring systems, alarms, etc.) in the design and engineering of reagent and other chemical feed storage systems. • Install process drains, sumps, and secondary containment structures to capture any inadvertent spills, leaks, and washdown of the area and/or equipment. **Additional Measures Identified to Further Reduce Impacts:** • None. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Conduct operational materials and wastes transportation in accordance with DOT regulations pertaining to proper packaging, labeling, and response to releases. • Manage operational materials and wastes in compliance with RCRA regulations pertaining to storage, labeling, containment, and disposal. • Develop and implement an SPCC plan per the Oil Pollution Prevention regulation under the CWA to prevent, control, and respond to releases of petroleum products during operations. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Pursue opportunities for beneficial use, rather than disposal, of secondary byproducts such as ammonium sulfate. **Additional Measures Identified to Further Reduce Impacts:** • None.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Human Health and Safety	**<u>Construction</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Protect worker safety during construction in conformance with provisions of the Occupational Safety and Health Act and the Office of Pipeline Safety guidelines. • Develop and implement an OSHA Process Safety Management Standard/EPA Risk Management Plan (PSMS/RMP) per 29 CFR 1910.119 and 40 CFR 68 to address onsite controls, protective measures, and emergency response procedures. • For pipelines carrying supercritical CO_2 fluids, select materials in consideration of the corrosive nature of CO_2 and trace gases and the potential for phase changes per pipeline safety guidelines. • Include appropriate pipeline siting and increase the depth of cover of the pipeline to reduce the potential for inadvertent contact from excavation or construction activities per 49 CFR 195. • Comply with the UIC permit and Well Works Permit to protect public health and safety. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Comply with the existing Site Construction Safety Program. This Program emphasizes risk identification and mitigation during pre-planning site activities to prevent accidents. • Comply with the existing hazardous communication program, monitoring procedures, a risk management program, site safety operating procedures, and process hazard analysis. **Additional Measures Identified to Further Reduce Impacts:** • None. **<u>Operations</u>** **Additional Measures Required by Laws, Regulations, and Ordinances:** • Protect worker safety during operations in conformance with provisions of the Occupational Safety and Health Act and the Office of Pipeline Safety guidelines. • Implement the PSMS/RMP in conformance with OSHA and EPA requirements set forth in 29 CFR 1910.119 and 40 CFR 68. • Comply with the UIC permit. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Implement a facility health and safety plan requiring training on the operating procedures and other requirements for safe operation of the project facilities. Provide annual refresher training for employees. • Monitor the system continuously so that it can be shut down quickly and isolated before a significant release could occur. • Install monitoring for piping systems as well as monitoring systems, rupture disks and water traps to trap any released vapor. **Additional Measures Identified to Further Reduce Impacts:** • Comply with DOT standard pipeline protection and safety measures (49 CFR 195) to minimize CO_2 pipeline failures, including: ▪ Internal pipeline inspection methods using smart pigs to detect corrosion, pitting, or other pipe imperfections; ▪ Frequent visual inspection and aerial surveys along pipeline ROWs to identify signs of damage or encroachment by vegetation or structures; ▪ A public awareness program to inform people how to identify the locations of pipelines and who to notify before conducting excavation work or digging, especially near the pipeline ROW; and ▪ Training of pipeline operator staff on emergency and maintenance procedures.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Utilities	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • Conduct pre-construction locating and demarcating of existing underground utilities (e.g., electric, telephone, cable, water, gas, and sewer) within the proposed pipeline alignments. • Prior to construction, perform a utility mark out (a survey to determine the location and depth of existing utilities) to ensure that the pipelines could be installed safely and to reduce the probability of equipment making contact with or damaging existing utilities. • Locate new pipelines within existing AEP transmission corridors to prevent the need to establish new ROWs to the extent possible. • Continue to coordinate with affected utility providers throughout final engineering and design phases. **Additional Measures Identified to Further Reduce Impacts:** • None. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Community Services	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.

Table 4.3-1. Mitigation Measures for the Proposed Mountaineer CCS II Project

Resource	Mitigation Measures
Socio-economics	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.
Environmental Justice	**Construction** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None. **Operations** **Additional Measures Required by Laws, Regulations, and Ordinances:** • None. **Measures Incorporated into Proposed Action to Reduce Impacts:** • None. **Additional Measures Identified to Further Reduce Impacts:** • None.

AEP = American Electric Power Service Corporation; BMP = best management practice; C&D = construction and demolition; CFR = Code of Federal Regulations; CO_2 = carbon dioxide; CWA = Clean Water Act; DOE = U.S. Department of Energy; DOT = U.S. Department of Transportation; DWWM = Division of Water & Waste Management; EPA = U.S. Environmental Protection Agency; HEL = highly erodible land; MVA = monitoring, verification, and accounting; NHPA = National Historic Preservation Act; NPDES = National Pollutant Discharge Elimination System; OSHA = Occupational Safety and Health Administration; PSMS = Process Safety Management Standard; RCRA = Resource Conservation and Recovery Act; RMP = Risk Management Plan; ROW = right-of-way; SHPO = State Historic Preservation Office; SPCC = Spill Prevention, Control, and Countermeasures; SWPPP = Stormwater Pollution Prevention Plan; UIC = Underground Injection Control; USACE = U.S. Army Corps of Engineers; WVDEP = West Virginia Department of Environmental Protection; WVDNR = West Virginia Division of Natural Resources

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4.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This section describes the amounts and types of resources that would be irreversibly and irretrievably committed for the proposed project. A resource commitment is considered *irreversible* when primary or secondary impacts from its use by the project would 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 spans of time (i.e., generally greater than 100 years), such as soil productivity. A resource commitment is considered *irretrievable* when the use or consumption of the resource by the project would only be renewable or recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or renewable natural resources that would be lost for a period of time (i.e., generally less than 100 years), but would recover or be available for use by future generations over time.

The principal resources that would be committed are the lands required for the construction of the project. These lands include the proposed CO_2 capture facility site at the Mountaineer Plant, the pipeline corridors requiring new construction, and the injection and monitoring well sites, as well as the target formations proposed for permanent CO_2 storage. Other resources that would be committed to the project include construction materials (e.g., steel, concrete) and process materials (e.g., ammonia, sulfuric acid) used for operations.

The amount of land that would be committed during construction of the project would include construction staging and laydown areas, pipeline construction ROWs, injection and monitoring well construction sites, and to a lesser extent, access road construction sites. The CO_2 capture facility would occupy 33 acres, the construction ROWs for pipeline corridors would occupy up to 400 acres, and the injection/monitoring well construction sites would require up to 120 acres. Collectively, up to 553 acres would be irretrievably committed during the 32-month construction phase.

The amount of land that would be committed during operation of the project would include the CO_2 capture facility site, permanent pipeline ROWs, injection/monitoring well sites, and new access roads. Collectively, up to 277 acres could be irretrievably committed during the operation phase of the project, which has a potential to last 20 years. These commitments are not viewed as irreversible, as lands would be allowed to return to prior uses after the potential 20-year operational life of the project is over, and the project is decommissioned. For this analysis, it is presumed that decommissioning would involve the removal or the proper closure and abandonment in place of project components.

All of the land proposed for the CO_2 capture facility and injection/monitoring well sites is already owned by AEP; therefore, there would be no loss of these lands as they would be used for their intended purpose by AEP. Temporary easements would be required during pipeline construction, and permanent easements would be maintained for the pipeline ROWs. The pipeline corridors would preclude farming only during construction, as any land currently being used for agricultural use would be returned to agricultural use after construction. Temporary and permanent easement lands would not be considered as an irreversible commitment of resources because lands in the ROWs would be returned to agricultural production with few restrictions. However, the loss of agricultural use of these lands during the proposed construction period would be an irretrievable commitment.

Natural habitat would be lost primarily where pipeline ROWs would cross wooded areas mainly along the Blessing Road Corridor and the East Corridor. The pipeline corridors would result in the loss of up to 100 acres of wooded areas primarily where new corridors would be required; however, only 39 acres would be maintained over the operational life of the project, while the remainder would be allowed to revert back to woods. After the project is concluded, the operational ROW could revert back to woods as well. This loss of wooded area is, therefore, considered an irretrievable commitment.

Injection of CO_2 into the subsurface would irreversibly commit portions of the Rose Run and Copper Ridge Formations to CO_2 storage. These formations within the injection zone would lose their ability to serve any other function, and would be dedicated to CO_2 storage. At more than 1.5 miles below the ground surface, these formations are situated substantially below potential coal seams in the area. Hence, the coal could be recovered in the future, during CO_2 injection operations or afterward, provided safeguards would be followed to avoid wells developed for injection and monitoring. Once CO_2 injection is completed, some wells and equipment at the injection well site could still be used for long-term monitoring purposes, but after removal of surface facilities, the land could return to other uses. As such, the short-term and limited commitment of coal resources is irretrievable, only during the construction period.

The project would use up to 1.9 mgd of process water (i.e., from the existing river water loop via the Ohio River) that would be committed for the potential 20-year operational lifespan of the project. Most of the water would be cycled through the evaporative condensers, where most of it would evaporate, and the balance would include chiller blowdown and purge water that would be treated at the project's WWTP before returning it to the river. Potable water from the New Haven Municipal Water and Sewer Department would also be consumed during construction (up to 0.05 mgd) and operation (up to 0.002 mgd). The only portion of the water that would not discharge directly back to groundwater or surface water would be the water that evaporates from the evaporative condensers (approximately 1.6 mgd). This water would not be available to the local area. These are considered irretrievable commitments of water resources.

Material and energy resources committed for the project would include construction materials (e.g., steel, concrete), electricity, and fuel (e.g., diesel, gasoline). All energy used during construction and operation would be irreversible. During operation, the project would use up to 3.2 million pounds of ammonia and up to 3.3 million pounds of sulfuric acid annually, which would be irreversibly committed.

The construction and operation of the project would require the obligation of human resources that would not be available for other activities during the commitment period. This would be an irretrievable commitment of resources.

Finally, the construction and operation of the project would require the commitment of fiscal resources by AEP, its investors and lenders, and DOE for the construction, demonstration, and operation of the project. This fiscal investment would be an irreversible commitment.

As described above, the project would result in irretrievable (i.e., lost for a period of time) commitments of primarily renewable natural and human resources. The project would also result in irreversible (i.e., permanently lost) commitment of portions of geologic storage formations, fiscal resources, energy, material resources, and fuel. However, DOE believes these commitments would reduce the overall, long-term environmental effects (i.e., GHG emissions) of using fossil energy resources and would fulfill national objectives as identified by the CCPI Program.

4.5 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

During the planned 20-year operational life of the Mountaineer CCS II Project, up to 277 acres of land would be used for the proposed CO_2 capture facility, pipeline corridors, injection and monitoring wells, and associated access roads. Easements would be required for the pipeline ROWs. The CO_2 capture facility would consume resources, including ammonia, sulfuric acid, water, and small quantities of process chemicals, paints, degreasers, and lubricants. The ammonium sulfate by-product would be recovered and marketed or properly disposed if no adequate market could be found.

A long-term benefit of the project from the perspective of DOE would be to achieve lower emissions of GHGs by capturing and storing up to 1.5 million metric tpy of CO_2. The widespread acceptance and employment of this technology could foster the overall long-term reduction in the rate of CO_2 emissions from coal-fueled power plants across the U.S., thereby reducing national GHG emissions. If the 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.

The project would reduce emissions of $CO_{2,}$ as well as regulated pollutants (e.g., SO_x) from the existing Mountaineer Plant. The project would result in a net reduction of approximately 18 percent in CO_2 emissions from the Mountaineer Plant (see Section 3.2, Greenhouse Gases). The project would support the objectives of the CCPI Program to demonstrate an advanced coal-based technology that captures and sequesters CO_2 emissions from a coal-fired power plant.

The project would enhance long-term productivity in the ROI through the direct, indirect, and induced creation of up to 800 jobs during the 32-month construction period. In addition, the project would result in a beneficial impact to the economy, employment, and tax base within the ROI over its operational life as a result of the 38 permanent jobs that would be created, as well as, the indirect and induced jobs created as a result of these permanent jobs (see Section 3.17, Socioeconomics).

Short-term uses of the environment would include the activities and associated impacts during the proposed construction and the operational lifespan of the project. Potential impacts to various resources have been described throughout Chapter 3. Potential resources impacts evaluated include the following:

- Air quality impacts as described in Section 3.1, Air Quality and Climate, including fugitive dust emissions during construction
- Erosion and sedimentation impacts on surface waters during construction as described in Section 3.4, Physiography and Soils, and Section 3.6, Surface Water
- Vegetation and wildlife habitat impacts caused by land-clearing activities, as described in Section 3.7, Wetlands and Floodplains, and Section 3.8, Biological Resources
- Aesthetic impacts from construction and operations affecting nearby residents as described in Section 3.10, Land Use and Aesthetics
- Traffic impacts during construction attributable to temporary detours and the movement of heavy equipment, plus increased traffic on local roadways during construction and operation, as described in Section 3.11, Traffic and Transportation
- Noise impacts from construction activities and operations, as described in Section 3.12, Noise

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5 REGULATORY AND PERMIT REQUIREMENTS

Council on Environmental Quality (CEQ) regulations for the National Environmental Policy Act (NEPA) Part 1502 Section 1502.25 states that, to the fullest extent possible, agencies shall prepare draft EISs concurrently with and integrated with environmental impact analyses and related surveys and studies required by environmental review laws and Executive Orders (EOs). It also requires a draft EIS list all federal permits, licenses, and other entitlements which must be obtained in implementing the proposed project. The following table contains relevant regulatory and permit requirements for the construction and operation of the Mountaineer CCS II Project to comply with CEQ regulations. The table identifies relevant federal regulatory requirements considered within the EIS including federal regulations and EOs, state regulations and permitting requirements, and local regulations and permitting requirements.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Federal Regulations and Permitting	
Clean Air Act, Title I, IV, and V 40 Code of Federal Regulations (CFR) 50 through 95	Establishes NAAQS set by the EPA for certain air pollutants. Applicable Titles: • Title I—Air Pollution Prevention and Control. Basis for air quality and emission limitations, PSD permitting program, SIPs, NSPS, and NESHAP. • Title IV—Acid Deposition Control. Establishes limitations on SO_2 and NO_x emissions, permitting requirements, monitoring programs, reporting and record keeping requirements, and compliance plans for emission sources. This Title requires that emissions of SO_2 from utility sources be limited to the amounts of allowances held by the sources. • Title V—Permitting. Required if the plant falls within 40 CFR 70.3 designations. This Title provides the basis for the Operating Permit Program and establishes permit conditions, including monitoring and analysis, inspections, certification, and reporting. Authority for implementation of the permitting program is delegated to the state of West Virginia.
Chemical Accident Prevention Act 40 United States Code (USC) 68 and Section 112(r) of the Clean Air Act Amendments	This Act requires stationary sources having more than a threshold quantity of the specific regulated toxic and flammable chemicals to develop a Risk Management Plan for submittal to the EPA, which then makes the information publicly available, including: • Hazard assessment that details the potential effects of an accidental release, an accident history of the last 5 years, and an evaluation of the worst-case and alternative accidental releases. • Prevention program that includes safety precautions and maintenance, monitoring, and employee training. • Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g., the fire department) should an accident occur. • The plan must be updated and resubmitted to the agency every 5 years.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Clean Water Act, Title IV 40 CFR 104 through 140	Focuses on improving the quality of water resources by providing a comprehensive framework of standards, technical tools, and financial assistance to address the many causes of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction. Applicable Sections: • Section 401—Certification. Provides states with the opportunity to review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state or tribal waters, including wetlands. The major federal permit subject to Section 401 review is a Section 404 permit. Every applicant for a Section 404 permit must request state certification that the proposed activity would not violate state or federal water quality standards. • Section 402—National Pollutant Discharge Elimination System (NPDES) Permit. Requires sources to obtain permits to discharge effluents and stormwaters to surface waters. The CWA authorizes EPA to delegate permitting, administrative, and enforcement duties to stage governments, while EPA retains oversight responsibilities. The state of West Virginia has been delegated NPDES authority and therefore would issue the NPDES permit. • Section 404 o Permits for Dredged or Fill Material. Regulates the discharge of dredged or fill material in the jurisdictional wetlands and waters of the United States. The USACE has been delegated the responsibility for authorizing these actions. o Nationwide Permit 12 Utility Line Activities. Authorizes the construction, maintenance, and repair of utility lines and the associated excavation, backfill, or bedding for the utility lines in all waters of the United States. The USACE has been delegated the responsibility for authorizing these actions.
Emergency Planning and Community Right-to-Know Act of 1986 42 USC 1101 *et seq.*	Requires that inventories of specific chemicals used or stored on site be reported on a periodic basis. The project would process or otherwise use substances subject to the Act's reporting requirements, such as anhydrous ammonia and sulfuric acid.
Endangered Species Act 16 USC 1536 *et seq.*	Enacted by Public Law 93-205, Endangered Species Act of 1973 (16 USC 1531 *et seq.*). Section 7, "Interagency Cooperation," requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. Under Section 7 of the Act, DOE has consulted with the USFWS and the WVDNR.
Farmland Protection Policy Act 7 USC 4201 *et seq.*	Directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The Act's purpose is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses.
Fish and Wildlife Conservation Act 16 USC 2901 *et seq.*	Encourages federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats.
Fish and Wildlife Coordination Act 16 USC 661 *et seq.*	Requires federal agencies undertaking projects affecting water resources to consult with the USFWS and the state agency responsible for fish and wildlife resources. These agencies are to be sent copies of this DEIS and their comments will be considered.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
General Conformity Rule 40 CFR 6, 51, and 93	Pursuant to this rule, an area that does not meet (or contributes to ambient air quality in a nearby area that does not meet) the primary or secondary National Ambient Air Quality Standards (NAAQS) for a criteria pollutant (CO, lead, NO_2, PM_{10}, $PM_{2.5}$, ozone, SO_2) is referred to as a nonattainment area. The CAA requires states to submit to the EPA a State Implementation Plan (SIP) for attainment of the NAAQS in nonattainment areas. The 1977 and 1990 amendments to the CAA require comprehensive SIP revisions for areas where one or more of the NAAQS have yet to be attained. The Clean Air Act Amendments required federal actions to show conformance with the SIP. Federal actions include, but are not limited to, those projects that are funded by federal agencies and the review and approval of a proposed action through a federal agency's NEPA process. Conformance with the SIP means that the federal action will not interfere with the approved SIPs purposes of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. The need to demonstrate conformity is applicable only to federal actions that occur in nonattainment areas or areas that were previously nonattainment and are currently designated as maintenance areas.
Greenhouse Gas Reporting Program 40 CFR 98	The Consolidated Appropriations Act, 2008 (H.R. 2764; Public Law 110–161) directed the EPA to develop a mandatory reporting rule for greenhouse gas emissions. The rule became effective December 29, 2009 and includes requirements for 31 emission source categories, including electric generation and general combustion sources. On April 12, 2010, EPA issued four new proposed rules that amend the Greenhouse Gas Reporting Rule (GGRR). These proposals would require reporting of emissions data from additional sources including facilities that inject and store CO_2 underground for the purposes of geologic sequestration or enhanced oil and gas recovery. In addition, EPA has proposed to add three new reporting requirements to the General Provisions (Subpart A) of the GGRR. EPA plans to finalize all four of these proposed rules so that they would become effective starting in 2011. On May 27, 2010, the Administrator signed a proposed rule that includes technical corrections, clarifications, and other amendments to the GGRR, but does not affect the reporting requirement.
Migratory Bird Treaty Act 16 USC 703 *et seq.*	Protects birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. The Act regulates the take and harvest of migratory birds. The USFWS will review this EIS to determine whether the activities analyzed would comply with the requirements of the Migratory Bird Treaty Act.
Bald and Golden Eagle Protection Act 16 USC 668-668d	Prohibits "taking" bald or golden eagles, including their parts, nests, or eggs. The Act defines "take" as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. Prohibits the disturbance of a bald or golden eagle to a degree that causes, or is likely to cause, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.
National Environmental Policy Act 42 USC 4371 *et seq.*	This EIS is being prepared to comply with NEPA, the federal law that requires agencies of the federal government to study the possible environmental impacts of major federal actions significantly affecting the quality of the human environment.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
National Historic Preservation Act 16 USC 470 *et seq.*	Under Section 106, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such federal agency shall afford the Advisory Council on Historic Preservation established under Title II of the Act a reasonable opportunity to comment with regard to such undertaking.
Native American Graves Protection and Repatriation Act 25 USC 3001	Directs the Secretary of the Interior to guide the repatriation of federal archaeological collections and collections that are culturally affiliated with Native American tribes and held by museums that receive federal funding. Major actions to be taken under this law include: • The establishment of a review committee with monitoring and policymaking responsibilities. • The development of regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims. • The oversight of museum programs designed to meet the inventory requirements and deadlines of this law. • The development of procedures to handle unexpected discoveries of graves or grave goods during activities on federal or tribal land.
New Source Performance Standards 40 CFR 60	The NSPS are technology-based standards applicable to new and modified stationary sources of regulated air emissions. Where the NAAQS emphasize air quality in general, the NSPS focus on particular sources of approximately 70 industrial source categories or sub-categories of sources (e.g., fossil fuel-fired generators, grain elevators, steam generating units) that are designated by size as well as type of process.
Noise Control Act 42 USC 4901 *et seq.*	Directs federal agencies to carry out programs in their jurisdictions “to the fullest extent within their authority” and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.
Notice to the Federal Aviation Administration 14 CFR 77	The FAA must be notified if any structures more than 200 ft. high would be constructed at the proposed site pursuant to 14 CFR 77. The FAA would then determine if the structures would or would not be an obstruction to air navigation.
Occupational Safety and Health Act 29 USC 651 *et seq.*	Compliance with the OSHA would be required according to OSHA standards. Applicable Rules: • OSHA General Industry Standards (29 CFR 1910) • OSHA Construction Industry Standards (29 CFR 1926)
Pollution Prevention Act 42 USC 13101 *et seq.*	Establishes a national policy for waste management and pollution control that focuses first on source reduction, and then on environmentally safe waste recycling, treatment, and disposal. Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition*, and Executive Order 13148, *Greening the Government through Leadership in Environmental Management*, provide guidance to agencies to implement the Pollution Prevention Act. DOE requires specific goals to reduce the generation of waste. DOE would implement a pollution prevention plan by incorporating such waste-reducing activities as ordering construction materials in correct sizes and numbers, resulting in very small amounts of waste; and implementing best management practices to reduce the volume of waste generated and reuse waste wherever possible.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Resource Conservation and Recovery Act 40 CFR 239 through 299	Regulates the treatment, storage, and disposal of hazardous wastes. Project participants would be required to identify any residues that require management as hazardous waste under RCRA (40 CFR 261). For some waste streams, this includes testing waste samples using the toxic characteristic leaching procedure or other procedures that measure hazardous waste characteristics. Applicable Title: Title II—Solid Waste Disposal (known as the Solid Waste Disposal Act), regulates the disposal of solid wastes. Title II, Subtitle C—Hazardous Waste Management, provides for a regulatory system to ensure the environmentally sound management of hazardous wastes from the point of origin to the point of final disposal. Title II, Subtitle D—State or Regional Solid Waste Plans.
Safe Drinking Water Act 42 USC 300 *et seq.*	Gives EPA the responsibility and authority to regulate public drinking water supplies by establishing drinking water standards, delegating authority for enforcement of drinking water standards to the states, and protecting aquifers from hazards such as injection of wastes and other materials into wells. The West Virginia Department of Health and Human Resources is the state agency responsible for enforcement. EPA regulations for this program are codified at 40 CFR 141.
Underground Injection Control Permit 40 CFR 144 through 146	A CO_2 injection well for geologic storage would require the issuance of an underground injection control (UIC) permit in accordance with 40 CFR 144 through 146 of the Safe Drinking Water Act. The State of West Virginia has been granted authority to issue and administer Class I-V wells permits. On December 10, 2010, EPA published a final rule, "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells" (Federal Register Vol. 75, No. 237). Under this rule, EPA created a new category of injection wells (Class VI wells) with new federal requirements to allow for injection of CO_2 for geologic sequestration to ensure the protection of underground sources of drinking water. West Virginia will have 270 days after the final rule publication to apply for state primacy of the Class VI wells. If West Virginia does not submit an application for primacy within the 270-day deadline, then permits would be issued from the federal UIC Class VI program. Until the West Virginia Class VI UIC program is approved, West Virginia would issue a permit under one of the existing classes, with the understanding that the permit would be re-issued as Class VI once primacy is achieved.
Executive Orders	
Executive Order 11514 *Protection and Enhancement of Environmental Quality*	This EO directs federal agencies to continuously monitor and control activities to protect and enhance the quality of the environment. The Order also requires agencies to develop procedures to ensure the fullest practical provision of timely public information and the understanding of federal plans and programs with potential environmental impacts, and to obtain the views of interested parties. DOE promulgated regulations (10 CFR 1027) and issued DOE Order 451.1b, *National Environmental Policy Act Compliance Program to* ensure compliance with this EO Because the Proposed Action is a Federal Action that requires NEPA analysis, DOE must comply with Order 451.1b.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Executive Order 11988 *Floodplain Management*; **Executive Order 11990** *Protection of Wetlands*	Executive Order 11988, Floodplain Management, directs federal agencies to establish procedures to ensure that they consider potential effects of flood hazards and floodplain management for any action undertaken. Agencies are to avoid impacts to floodplains to the extent practical. Executive Order 11990, Protection of Wetlands, requires federal agencies to avoid short- and long-term impacts to wetlands if a practical alternative exists. DOE regulation 10 CFR 1022 establishes procedures for compliance with these Executive Orders. Where no practical alternatives exist to development in floodplain and wetlands, DOE is required to prepare a floodplain and wetlands assessment discussing the effects on the floodplain and wetlands, and consideration of alternatives. In addition, these regulations require DOE to design or modify its actions to minimize potential damage in floodplains or harm to wetlands. DOE is also required to provide opportunity for public review of any plans or proposals for actions in floodplains and new construction in wetlands. A statement of findings from the assessment will be incorporated into the Final EIS.
Executive Order 12856 *Right-to-Know Laws and Pollution Prevention Requirements*	Directs federal agencies to reduce and report toxic chemicals entering any waste stream, improve emergency planning, response, and accident notification, and encourage the use of clean technologies and testing of innovative prevention technologies. In addition, this Order states that federal agencies are persons for purposes of the Emergency Planning and Community Right-to-Know Act, which requires agencies to meet the requirements of the Act.
Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	Requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
Executive Order 13007 *Indian Sacred Sites*	Directs federal agencies, to the extent permitted by law and not inconsistent with agency missions, to avoid adverse effects to sacred sites and to provide access to those sites to Native Americans for religious practices. This Order directs agencies to plan projects to provide protection of and access to sacred sites to the extent compatible with the project.
Executive Order 13101 *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition*	Directs federal agencies to incorporate waste prevention and recycling in each agency's daily operations and work to increase and expand markets for recovered materials through preference and demand for environmentally preferable products and services.
Executive Order 13112 *Invasive Species*	Directs federal agencies to prevent the introduction of or to monitor and control invasive (non-native) species, to provide for restoration of native species, to conduct research, to promote educational activities, and to exercise care in taking actions that could promote the introduction or spread of invasive species.
Executive Order 13148 *Greening the Government through Leadership in Environmental Management*	Makes the head of each federal agency responsible for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning across all agency missions, activities, and functions.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*	Directs federal agencies to establish regular and meaningful consultation and collaboration with tribal governments in the development of federal policies that have tribal implications, to strengthen United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates on tribal governments.
Executive Order 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds*	Requires federal agencies to avoid or minimize the negative impacts of their actions on migratory birds, and to take active steps to protect birds and their habitats. • Directs each federal agency taking actions having or likely to have a negative impact on migratory bird populations to work with the USFWS to develop an agreement to conserve those birds. • Directs agencies to avoid or minimize impacts to migratory bird populations, take reasonable steps that include restoring and enhancing habitat, prevent or abate pollution affecting birds, and incorporate migratory bird conservation into agency planning processes whenever possible. • Requires environmental analyses of federal actions to evaluate effects of those actions on migratory birds, to control the spread and establishment in the wild of exotic animals and plants that could harm migratory birds and their habitats, and either to provide advance notice of actions that could result in the take of migratory birds or to report annually to the USFWS on the numbers of each species taken during the conduct of agency actions.
West Virginia State Regulations and Permitting	
Aboveground Storage Tank Registration 47 Code of State Rules (CSR) 58	The Groundwater Protection Rule requires a permit for any facility using an above ground storage tank that stores fluids potentially harmful to groundwater. A facility map should be submitted labeling the locations of the processes or activities that may influence groundwater.
Access Permit 157 CSR 6 §17-16-6	A permit is required when occupying a Division of Highway's right-of-way.
Air Emissions Permit 45 CSR 13	Construction, modification or relocation permits required for stationary sources of air pollutants.
Cultural Resources Review 82 CSR 1	State review required under National Historic Preservation Act.
Public Lands Permit	A state-wide Right of Entry Permit provides legal real-estate entry to a streambed for any construction activity. It is required for any stream bed disturbance on a stream that flows at least six months per year, is named on a USGS Topographic map, is named on a Division of Highways county road map, or has been locally recognized and named.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
West Virginia Building Code 87 CSR 4 4.1.a 4.1.b 4.1.c 4.1.k 87 CSR 1 (fire)	International Building Code — Covers the construction of all buildings except detached one- and two-family dwellings and multiple single-family dwellings not more than three stories high (townhouses). Regulations include weather-resistance, ventilation, sanitation, fire-safety, structural integrity, user safeguards, etc. West Virginia's nonresidential code is published by the International Code Council (ICC). International Plumbing Code—Governs the installation of plumbing systems in new buildings, additions to buildings, and buildings undergoing alterations. Regulated subjects include water supply piping, waste and vent piping, roof drain piping, backflow protection, plumbing fixtures, etc. International Mechanical Code—Governs the installation and maintenance of heating, ventilating, cool, and refrigeration systems. Regulated subjects include furnaces, ductwork, hot water heat, commercial kitchen ventilation, gas piping, exhaust ventilation, etc. 2008 National Electric Code—Adopts a national standard for the installation of electrical wiring, apparatus, and equipment for electric light, heat, power, technology circuits and systems, and alarm and communication systems, as published by the National Fire Protection Association. West Virginia State Fire Code—Addresses conditions hazardous to life and property from fire, explosion, hazardous material storage, handling, or use and use of and occupancy of buildings and structures.
NPDES General Construction Stormwater Permit 47 CSR 10	The WV DEP developed and issued a General WV/NPDES Water Pollution Control Permit to regulate sediment laden stormwater flowing into the waters of the State from discharges associated with construction activities. Any person proposing a construction activity, three (3) acres or greater of land disturbance in size, shall submit a Site Registration Application Form 45 days prior to commencing the operation. When the construction activity is owned by one person but operated by another, it is the responsibility of the owner (developer) to obtain the permit. When the construction activity is completed and all disturbed areas are stabilized, the responsible party must submit a Notice of Termination (NOT) in order to end coverage under the General Permit.
NPDES Non-stormwater Hydrostatic Testing General Permit 47 CSR 13	The Hydrostatic Testing General Permit is required for any establishment with discharges composed entirely of waters from hydrostatic testing of new pipeline and agreeing to be regulated under the terms of the General Permit.
Underground Injection Permit 47 CSR 13	Underground Injection Class V experimental well permit is needed to operate the CO_2 injection wells.
Well Works Permit 35 CSR 4	Well works permits are required in West Virginia for drilling deep wells that are used for geologic characterization or other non-producing deep wells.
West Virginia Air Pollution Control Act (APCA)	West Virginia Air Pollution Control Act (APCA) charges the West Virginia DEP with regulating air quality in the state. The DEP adopts and enforces air quality standards, emission control requirements, and other air regulations. The West Virginia clean air program follows the requirements of the federal Clean Air Act (CAA). The EPA and DEP work cooperatively to enforce these requirements.
Rules & Regulations for the Government of Electric Utilities 150 CSR 3	These rules govern the operation and service of electric utilities subject to the jurisdiction of the Public Service Commission (PSC) of West Virginia.

Table 5.1. Relevant Regulatory and Permit Requirements for the Proposed Project

Statute, Regulation, Order	Description
Air Quality Permit for Coal Plants 45 CSR 5	Air quality permit for coal preparation plants and coal handling operations required to prevent and control air pollution caused by the construction, modification, relocation or operation of coal preparation plants and/or coal handling operations.
Public Land Corporation's Stream Activity Application	An application must be submitted to the West Virginia Department of Natural Resource's Real Estate Management division for any type of proposed activity within the state's streams. Application must provide details on the type of equipment to be used in the stream, amount of material to be dredged (if any), plan for disposing of dredged materials, length of stream/bank to be worked or type of size of structure to be placed in the stream.
West Virginia Water Pollution Control Act (WPCA)	The principal water quality law in the state of West Virginia is the WPCA. The WPCA designates the West Virginia Office of Water Resources (OWR), within the Division of Environmental Protection (DEP) as the water pollution control agency for the state. The OWR is charged with preserving the integrity of the state's water resources. These water resources include streams, lakes, rivers, wetlands, and groundwater. Under this act, a State 401 certification is required to ensure that any proposed dredge or fill material into waters of the State will comply with state water quality standards.
Water Resources Protection Act	In 2004, the West Virginia legislature passed this Act to gather information regarding the quantity and use of surface and groundwater resources in the State. The WVDEP has been charged with implementing the requirements of the Act. One of the main components of the Act is a survey of large quantity water users (I.e. greater than 750,000 gallons of water during any given month within a calendar year) in the State. Completion of the survey is mandatory for any company or business that meets the above definition.
West Virginia Water Quality Standards	The West Virginia Environmental Quality Board (EQB) sets water quality standards, reclassifies designated water uses, and sets site specific numeric criteria. The West Virginia administrative code sets out the water quality standards for the various water use categories.
Yard Waste Composting Rule 33 CSR 3	This legislative rule establishes requirements for the proper handling and composting of yard waste including siting, bonding, design, construction, modification, operation, closure and permitting procedures pertaining to any facility or activity that generates, processes, composts or otherwise reuses or recycles yard waste by whatever means and sets forth requirements for operator training and certification. Registration is required for non-residential composting activities that are not considered Commercial Yard Waste Composting Facilities.

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6 AGENCIES AND TRIBES CONTACTED

6.1 FEDERAL AGENCIES

Advisory Council on Historic Preservation, Office of Federal Agency Programs
Federal Energy Regulatory Commission, Office of Energy Projects
Office of Federal Agency Programs, Advisory Council on Historic Preservation
U.S. Army Corps of Engineers, Huntington District, Racine Lock
U.S. Department of Commerce, Economic Development Administration
U.S. Department of the Interior, Office of Environmental Policy and Compliance
U.S. Department of Transportation, Office of Transportation Policy (P-32)
U.S. Environmental Protection Agency, Office of Federal Activities
U.S. Environmental Protection Agency, Region 3
U.S. Fish and Wildlife Service, West Virginia Field Office Ecological Services
U.S. House of Representatives, Congressional District
U.S. Senate
U.S. Senate Subcommittee on Energy and Water Development Committee on Appropriations

6.2 WEST VIRGINIA AGENCIES

West Virginia Department of Environmental Protection
West Virginia Division of Culture and History, The Cultural Center
West Virginia Division of Energy
West Virginia Division of Natural Resources, Natural Heritage Program
West Virginia Governor
West Virginia House of Delegates, District 2

6.3 OHIO AGENCIES

Ohio Environmental Protection Agency
Ohio Historical Society, Historic Preservation Division

6.4 NATIVE AMERICAN TRIBES

Cayuga Nation
Delaware Nation
Keweenaw Bay Indian Community
Prairie Band of Potawatomi Nation
Seneca Nation of Indians
Seneca-Cayuga Tribe of Oklahoma
Shawnee Tribe
Wyandotte Nation

6.5 LOCAL AND REGIONAL AGENCIES

Mason County Commission
Meigs County Commission
New Haven Town Council
Village of Pomerory
Village of Racine
Town of Hartford, Mayor
Town of New Haven, Mayor

6.6 OTHER ORGANIZATIONS

American Association of Blacks in Energy
American Coal Ash Association
Blue Ridge Environmental Defense League
Citizens for Clean Energy, Inc.
National Coal Council
National Congress of American Indians
Rural Utilities Service
United States Energy Association

7 DISTRIBUTION LIST

7.1 ELECTED OFFICIALS

The Honorable Joe Manchin, III United States Senate	The Honorable Shelley Moore Capito United States House of Representatives U.S. Representative, Congressional District 2
The Honorable John D. Rockefeller, IV United States Senate	The Honorable Earl Ray Tomblin Governor of West Virginia
The Honorable Sherrod Brown United States Senate	The Honorable Bill Johnson United States House of Representatives U.S. Representative, Congressional District 6
The Honorable Rob Portman United States Senate	The Honorable John Kasich Governor of Ohio

7.2 APPROPRIATIONS COMMITTEES

The Honorable Daniel Inouye, Chairman Committee on Appropriations United States Senate	The Honorable Thad Cochran, Ranking Member Committee on Appropriations United States Senate
The Honorable Barbara Boxer, Chairwoman Committee on Environment and Public Works United States Senate	The Honorable James M Inhofe, Ranking Member Committee on Environment and Public Works United States Senate
The Honorable Jeff Bingaman, Chairman Committee on Energy and Natural Resources United States Senate	The Honorable Lisa Murkowski, Ranking Member Committee on Energy and Natural Resources United States Senate
The Honorable Fred Upton, Chairman Committee on Energy and Commerce United States House of Representatives	The Honorable Henry A Waxman, Ranking Member Committee on Energy and Commerce United States House of Representatives
The Honorable Dianne Feinstein, Chairwoman The Subcommittee on Energy and Water Development Committee on Appropriations United States Senate	The Honorable Lamar Alexandar, Ranking Member The Subcommittee on Energy and Water Development Committee on Appropriations United States Senate

7.3 STATE ELECTED OFFICIALS

Mrs. Karen Facemyer West Virginia State Senator, District 4	Mr. Dale Martin West Virginia House of Delegates, District 13

Mr. Mike Hall West Virginia State Senator, District 4	Mr. Brady Paxton West Virginia House of Delegates, District 13

7.4 FEDERAL AND STATE AGENCIES

Mr. Reid Nelson Director, Office of Federal Agency Programs Advisory Council on Historic Preservation	Ms. Camille Mittelholtz Deputy Director, Office of Safety, Energy and Environment Office of Transportation Policy (P-32) U.S. Department of Transportation
Ms. Denali Daniels Energy Senior Program Manager Denali Commission	Ms. Barbara Rudnick NEPA Program Team Leader U.S. Environmental Protection Agency, Region 3
Mr. Jeff Wright Director, Office of Energy Projects Federal Energy Regulatory Commission	Ms. Susan Bromm Director, Office of Federal Activities U.S. Environmental Protection Agency
Ohio Historic Preservation Office Historic Preservation Division Ohio Historical Society	LRH Operations, Racine Lock U.S. Army Corps of Engineers, Huntington District
Mr. Scott Nally, Director Ohio Environmental Protection Agency	Ms. Barbara Douglas West Virginia Field Office Ecological Services U.S. Fish and Wildlife Service
Mr. Mark Plank Rural Utilities Service	Ms. Susan Pierce Deputy State Historic Preservation Officer West Virginia Division of Culture and History
Dennis Alvord Economic Development Administration U.S. Department of Commerce	Ms. Kelly A. Bragg Program Coordinator West Virginia Division of Energy
Mr. Michael T. Chezik Regional Environmental Officer U.S. Department of the Interior	Mr. Randy C. Huffman Cabinet Secretary West Virginia Department of Environmental Protection
Mr. Willie R. Taylor, Director Office of Environmental Policy and Compliance U.S. Department of the Interior	Ms. Barbara Sargent West Virginia Division of Natural Resources Natural Heritage Program

7.5 REGIONAL AND LOCAL OFFICIALS

Mr. Bob Baird County Commissioner Mason County Commission	Mr. Miles Epling County Commissioner Mason County Commission

Mr. Rick Handley County Commissioner Mason County Commission	Mr. John Musser Mayor Village of Pomeroy
Mr. George Gribbs Mayor, New Haven	Mr. James Elias Town Council, New Haven
Ms. Sarah Gibbs Town Council, New Haven	Ms. Dorthy Roush Town Council, New Haven
Mr. Jeff Russell Town Council, New Haven	Mr. Francis Taylor Town Council, New Haven
Mr. Michael Bartrum President Meigs County Commission	Mr. Tim Ihle Vice President Meigs County Commission
Mr. Thomas Anderson Commissioner Meigs County Commission	Mr. Sam Anderson Mayor Hartford
Ms. Lois Dudding Town Council, Hartford	Ms. D.D. Dudding Town Council, Hartford
Ms. Susan Kensler Town Council, Hartford	Mr. Tim Greene Town Council, Hartford
Mr. Julian Scott Hill Mayor Village of Racine	Mr. David Spencer Clerk/Treasurer Village of Racine
Mr. Ronald Clark Town Council, Village of Racine	Mr. Dale Hart Town Council, Village of Racine
Mr. Tom Reed Town Council, Village of Racine	Mr. Ike Spencer Town Council, Village of Racine
Mr. Tim Hill Town Council, Village of Racine	Mr. Ivan Powell Town Council, Village of Racine
Mr. Jerry Tucker Mayor Mason	Mr. Ralph Ross Town Council, Mason
Ms. Sara Stover Town Council, Mason	Mr. Marty Hager Town Council, Mason
Ms. Amber White Town Council, Mason	Ms. Paula Gregory Town Council, Mason

7.6 NATIVE AMERICAN TRIBAL GOVERNMENT/NATIONS

Mr. Franklin Keel Regional Director Eastern Regional Office Bureau of Indian Affairs	Mr. Steve Ortiz, Chairperson Prairie Band of Potawatomi Nation

Mr. Clint Halftown, Nation Representative Cayuga Nation	Mr. Barry E. Snyder, Sr., President Seneca Nation of Indians
Mr. LeRoy Howard, Chief Seneca-Cayuga Tribe of Oklahoma	Mr. Leaford Bearskin, Chief Wyandotte Nation
Mr. Kerry Holton Delaware Naton	Mr. Ron Sparkman, Chairman Shawnee Tribe
Mr. Warren C. Swartz, Jr., President Keweenaw Bay Indian Community	

7.7 NATIONAL AND REGIONAL NONGOVERNMENTAL ORGANIZATIONS AND GOVERNMENTAL ASSOCIATIONS

Mr. Frank M. Stewart President American Association of Blacks in Energy	Mr. Robert Beck Executive Vice President National Coal Council
Mr. Thomas H. Adams Executive Director American Coal Ash Association	Ms. Jacqueline Pata Executive Director National Congress of American Indians
Mr. Louis Zeller Blue Ridge Environmental Defense League	Mr. Barry K. Worthington Executive Director United States Energy Association
Mr. Richard Liebert Chairman Citizens for Clean Energy, Inc.	Mason City Historical Society
Mason County Genealogical-Historical Society	

7.8 LIBRARIES

New Haven Public Library	Meigs County Library District

7.9 INTERESTED PARTIES

Professor Paul Friesema Environmental Policy and Culture Program Northwestern University	Mr. Tyson Taylor
Mr. Robert Titus	

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Disclosure Statement

Environmental Impact Statement
Mountaineer Commercial Scale Carbon Capture and Storage Project
DOE / EIS-0445

CEQ Regulations at 40CFR 1506.5(c), which have been adopted by the DOE (10CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for the purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at question 17a and b.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certifies as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a)	X	Has no past, present, or currently planned financial interest in the outcome of the project.
(b)		Has the following financial interest in the outcome of the project and hereby agrees to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.
2.
3.

Contractual Interest:

(a)	X	Has no past, present, or currently planned financial interest in the outcome of the project.
(b)		Has the following financial interest in the outcome of the project and hereby agrees to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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2.
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Organizational Interest:

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Other Interest:

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(b)		Has the following financial interest in the outcome of the project and hereby agrees to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.
2.
3.

Certified by:

[signature] 2/3/2011
Signature Date

Frederick J. Carey, President
Name & Title (Printed)

Potomac-Hudson Engineering, Inc.
Company

Disclosure Statement

Environmental Impact Statement
Mountaineer Commercial Scale Carbon Capture and Storage Project
DOE / EIS-0445

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Certified by:

Signature Date

Jeff Brandt
Name & Title (Printed)

TRC Environmental Corporation
Company

Disclosure Statement

Environmental Impact Statement
Mountaineer Commercial Scale Carbon Capture and Storage Project
DOE / EIS-0445

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Certified by:

Karen V. Summers 2/2/2011
Signature Date

Karen V. Summers Director
Name & Title (Printed)

Tetra Tech, Inc.
Company

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