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 ($100\ \mu g/m^3$)	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	$0.15\ \mu g/m^3$	rolling 3-month average[f]	same as primary
	$1.5\ \mu g/m^3$	quarterly average	same as primary
PM_{10}	$150\ \mu g/m^3$	24-hour[g]	same as primary
$PM_{2.5}$	$15.0\ \mu g/m^3$	annual[h] (arithmetic mean)	same as primary
	$35\ \mu g/m^3$	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 ($1300\ \mu g/m^3$); 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 $15.0\ \mu g/m^3$.

[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 $35\ \mu g/m^3$ (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; $\mu g/m^3$ = 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.

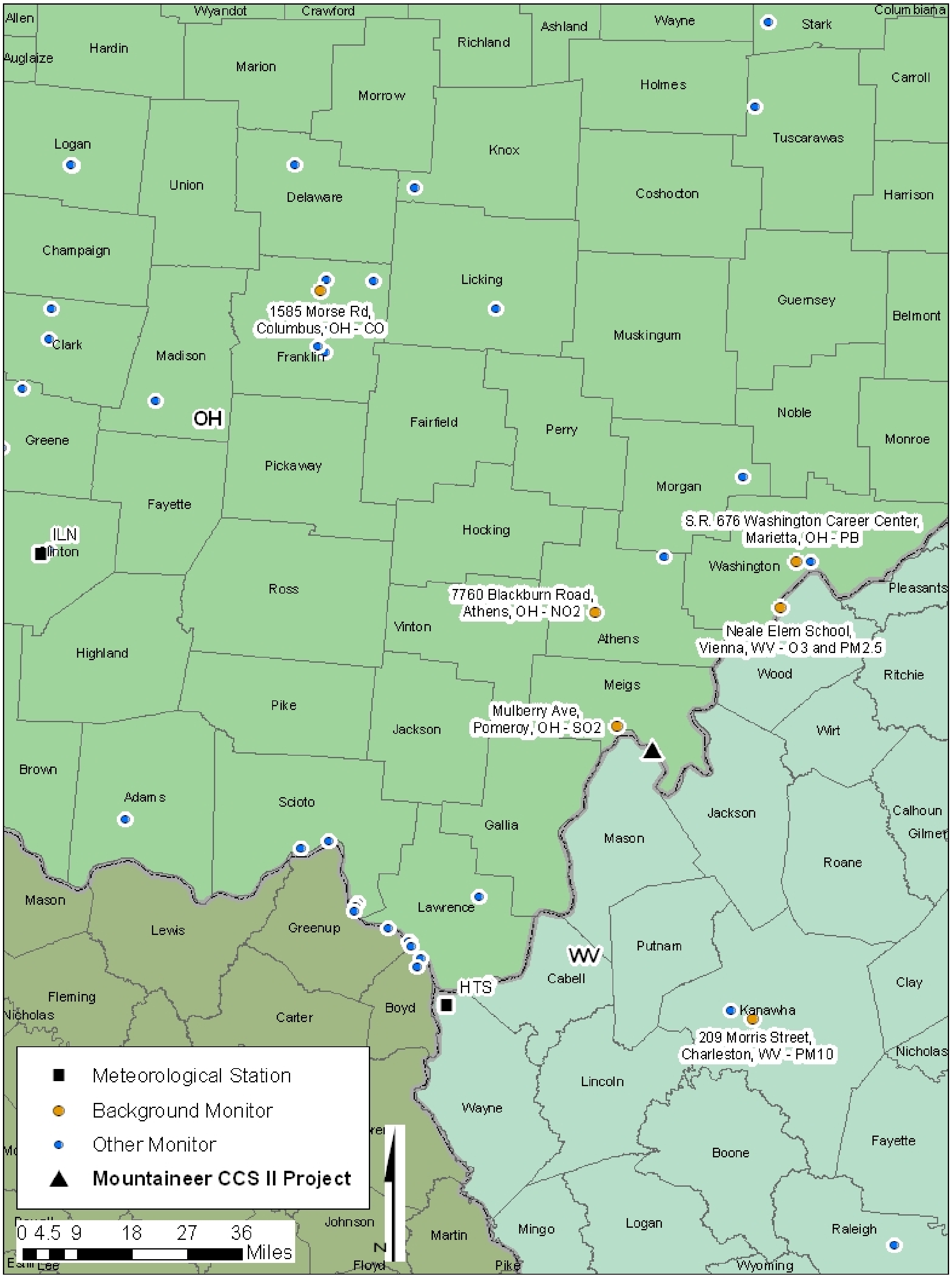


Figure 3.1-1. Locations of Ambient Air Quality Monitoring Stations near the Project Site Area

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 (µg/m³)	Background Concentration[a] (µg/m³)				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.

µg/m³ = 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.

<u>CO_2 Capture Facility</u>

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.

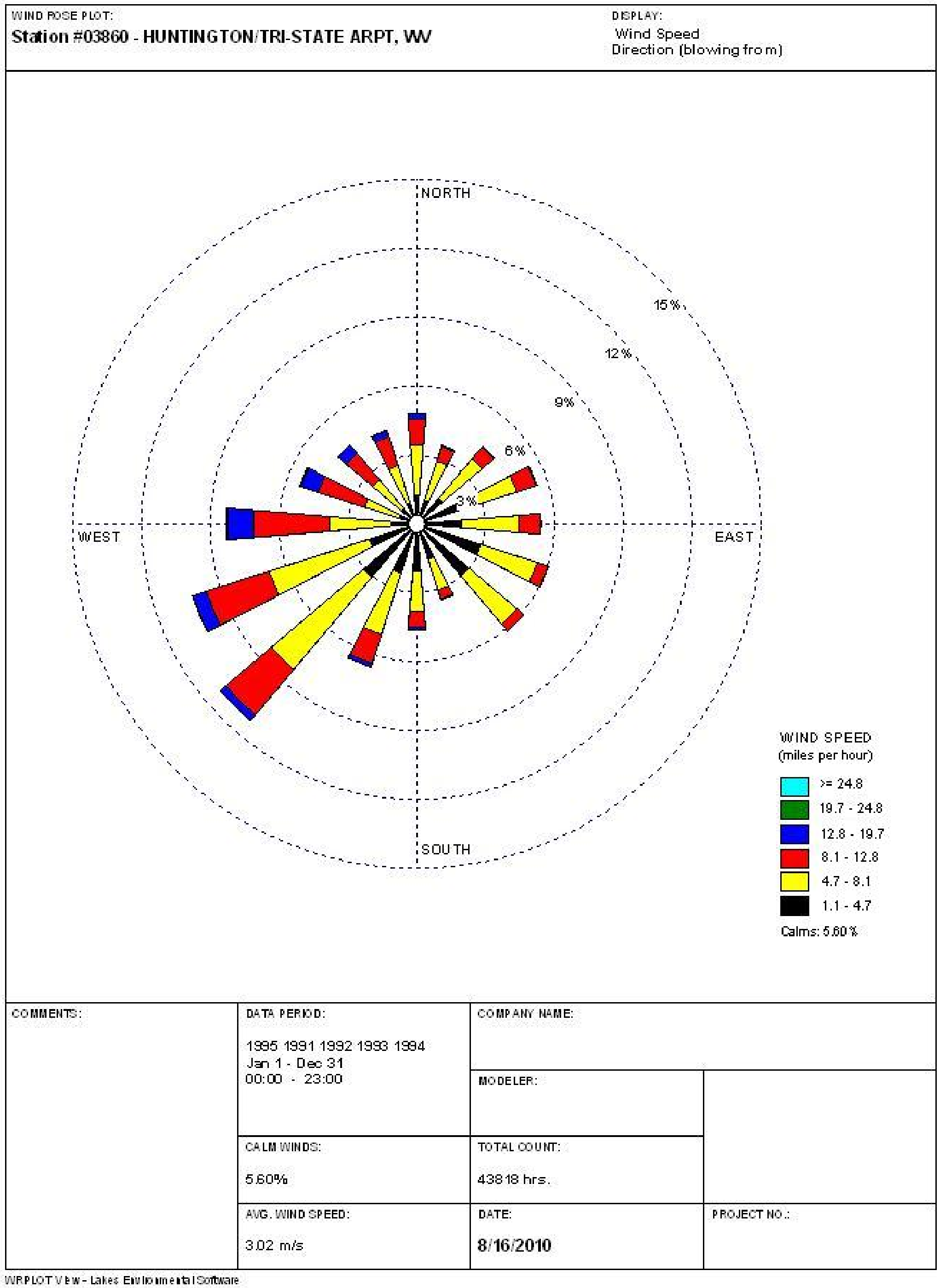


Figure 3.1-2. Wind Rose for the Huntington Tri-State Airport National Weather Service Station, 1991-1995

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.

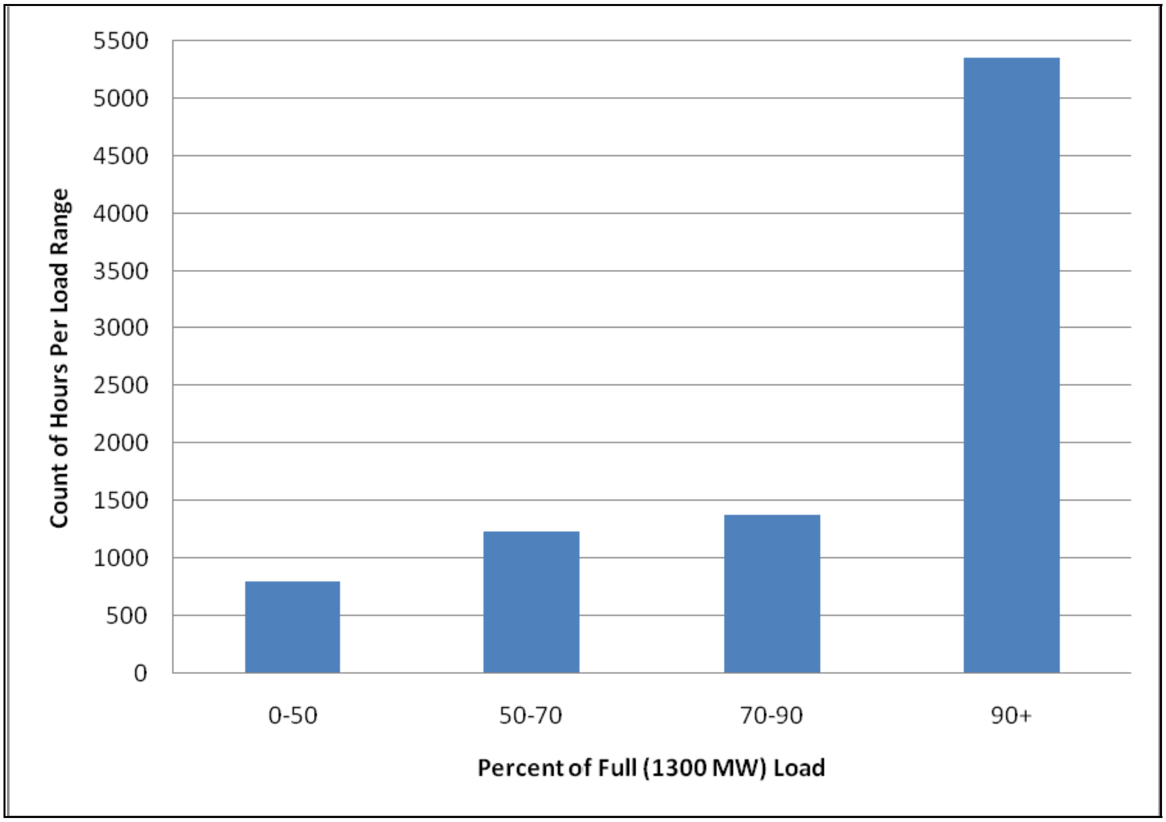
Table 3.1-17. Mountaineer Plant: Estimated Stack Parameters without and with the Project

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.

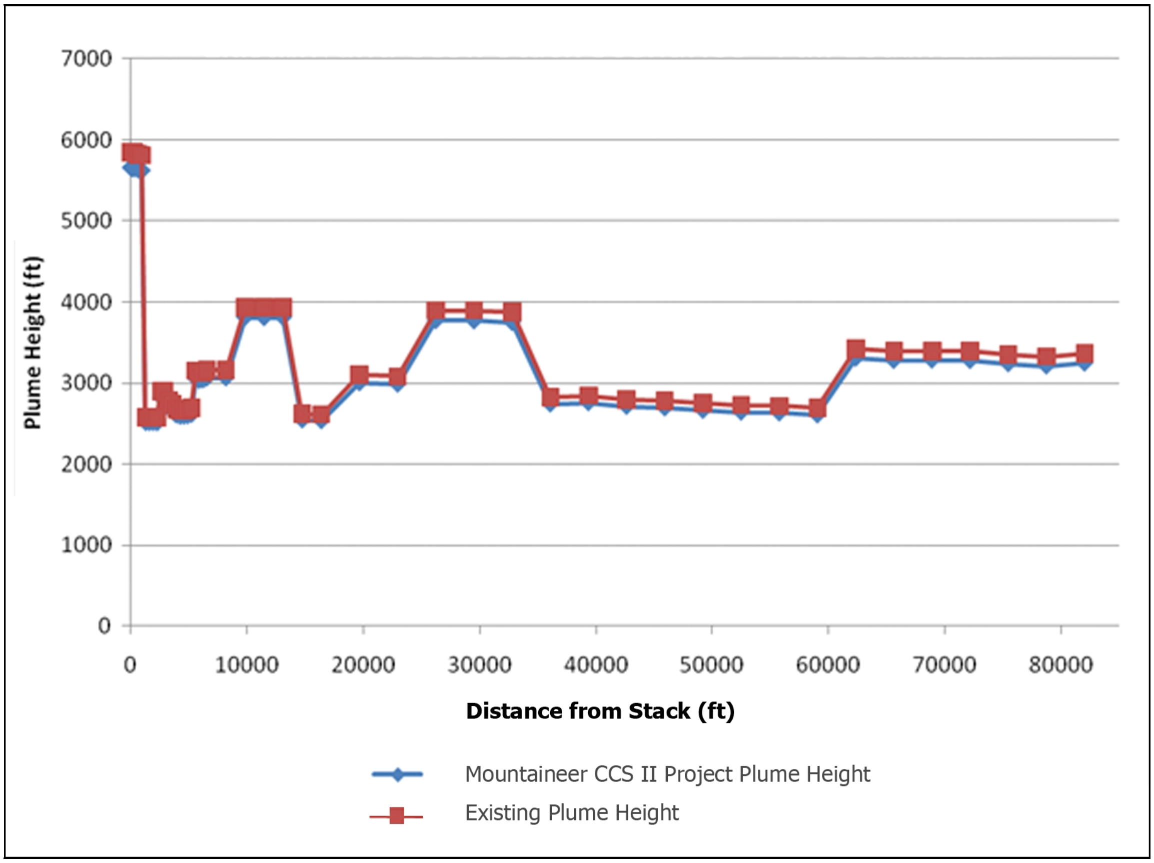


Figure 3.1-4. Exhaust Stack Plume Height vs. Distance under Full Load and Full Meteorological Conditions, with and without the Project

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).

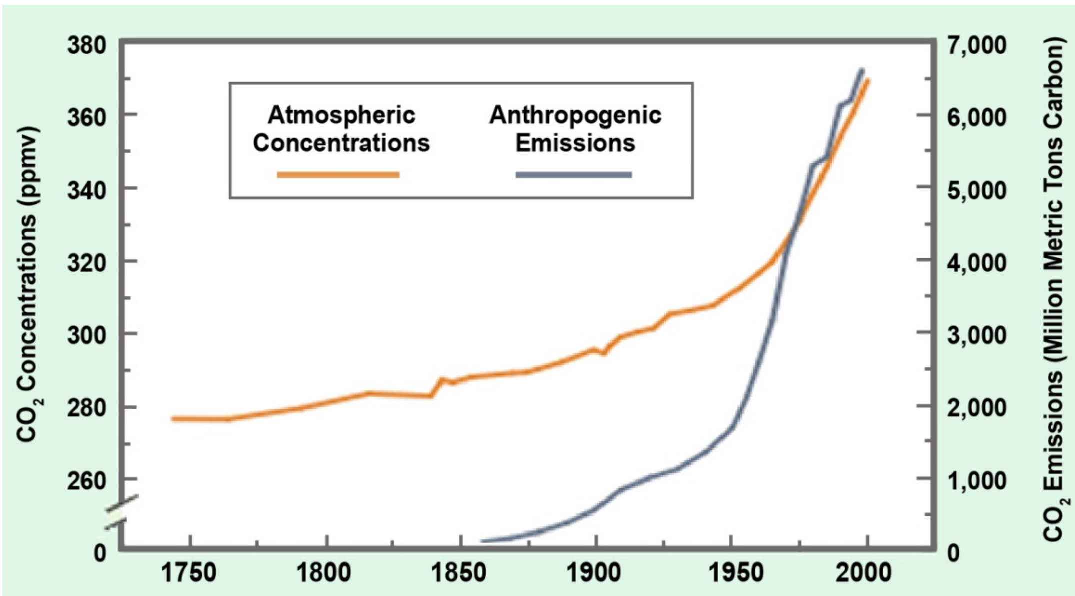


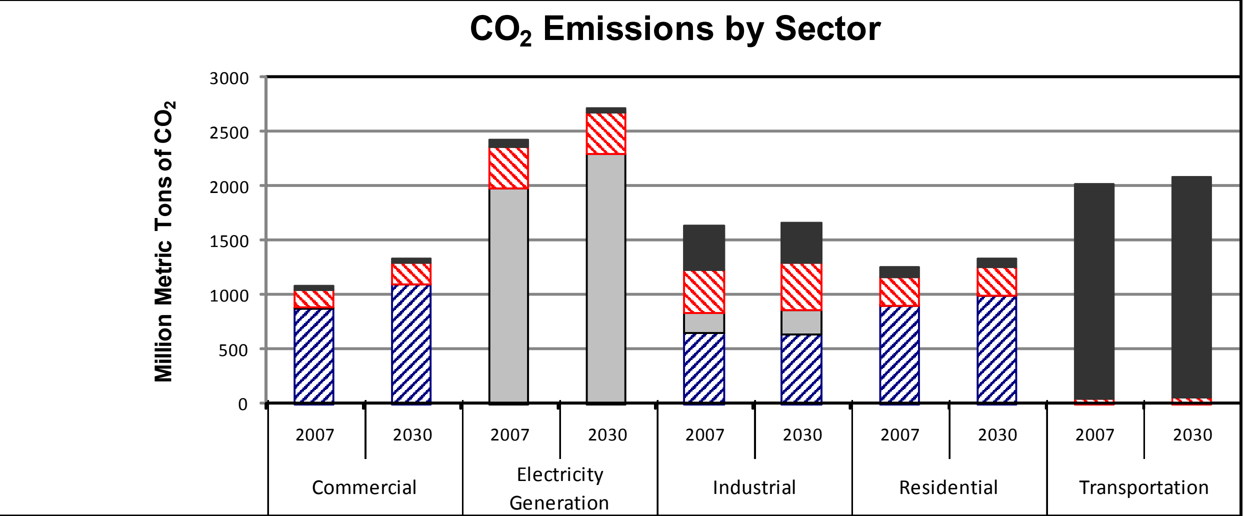
Figure 3.2-1. Historical Trends in Global Atmospheric CO_2 Concentrations and Emissions

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.

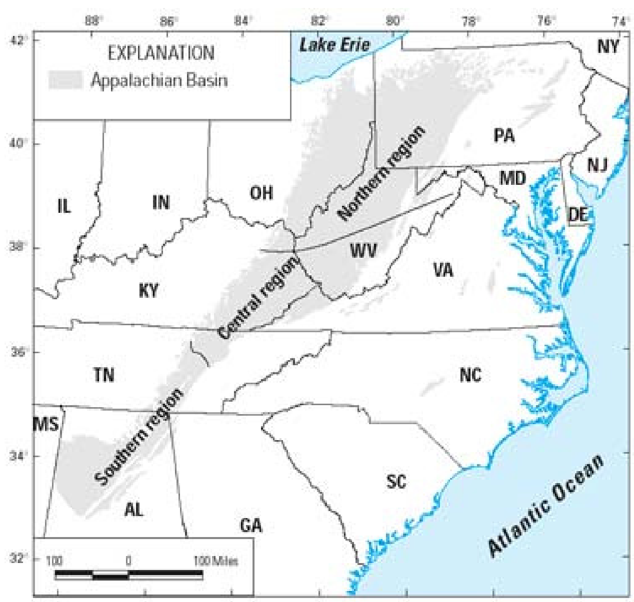

Figure 3.3-1. The Appalachian Basin

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.

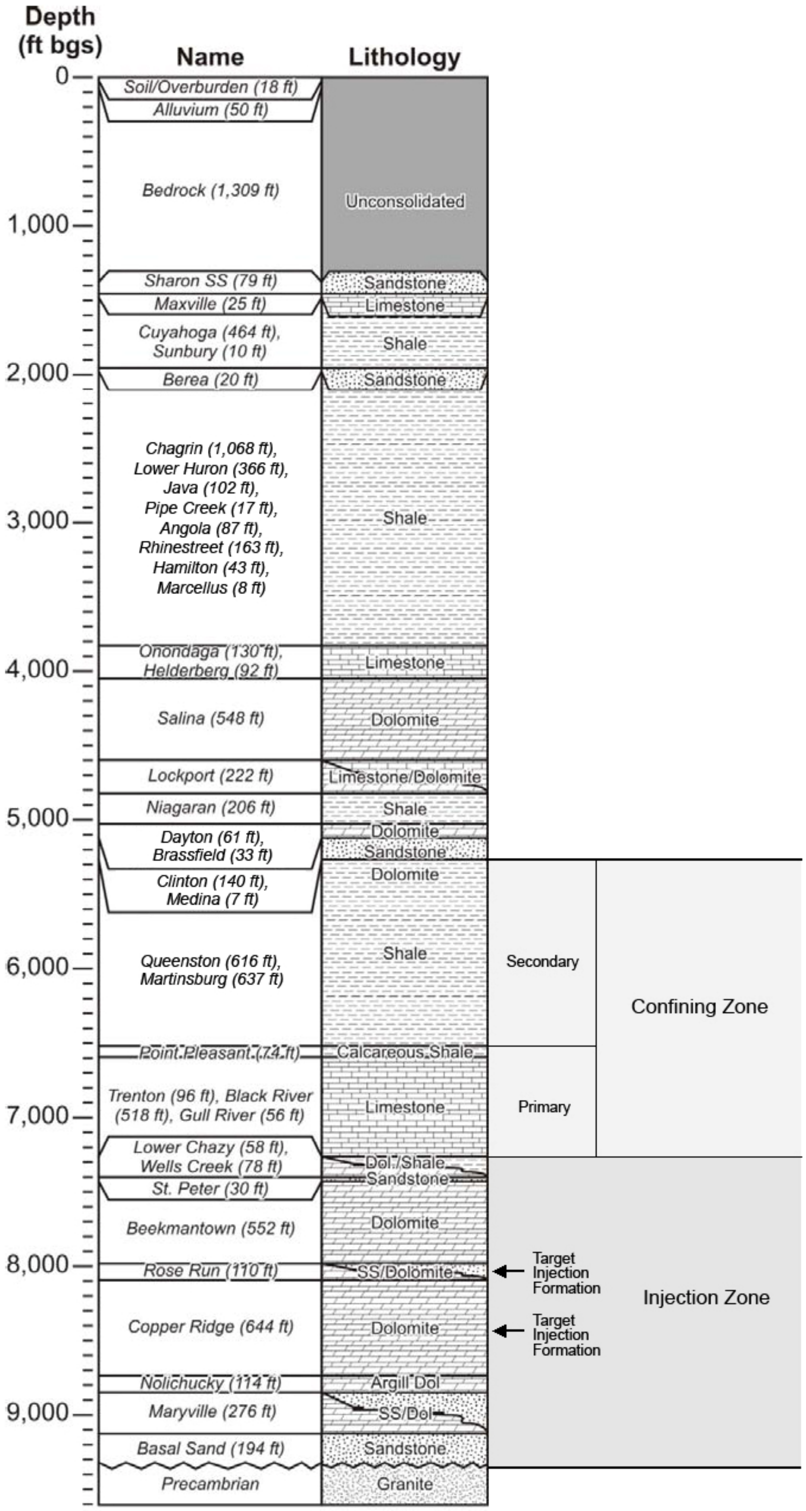

Figure 3.3-2. Summary of the Stratigraphy of West Virginia and the ROI

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

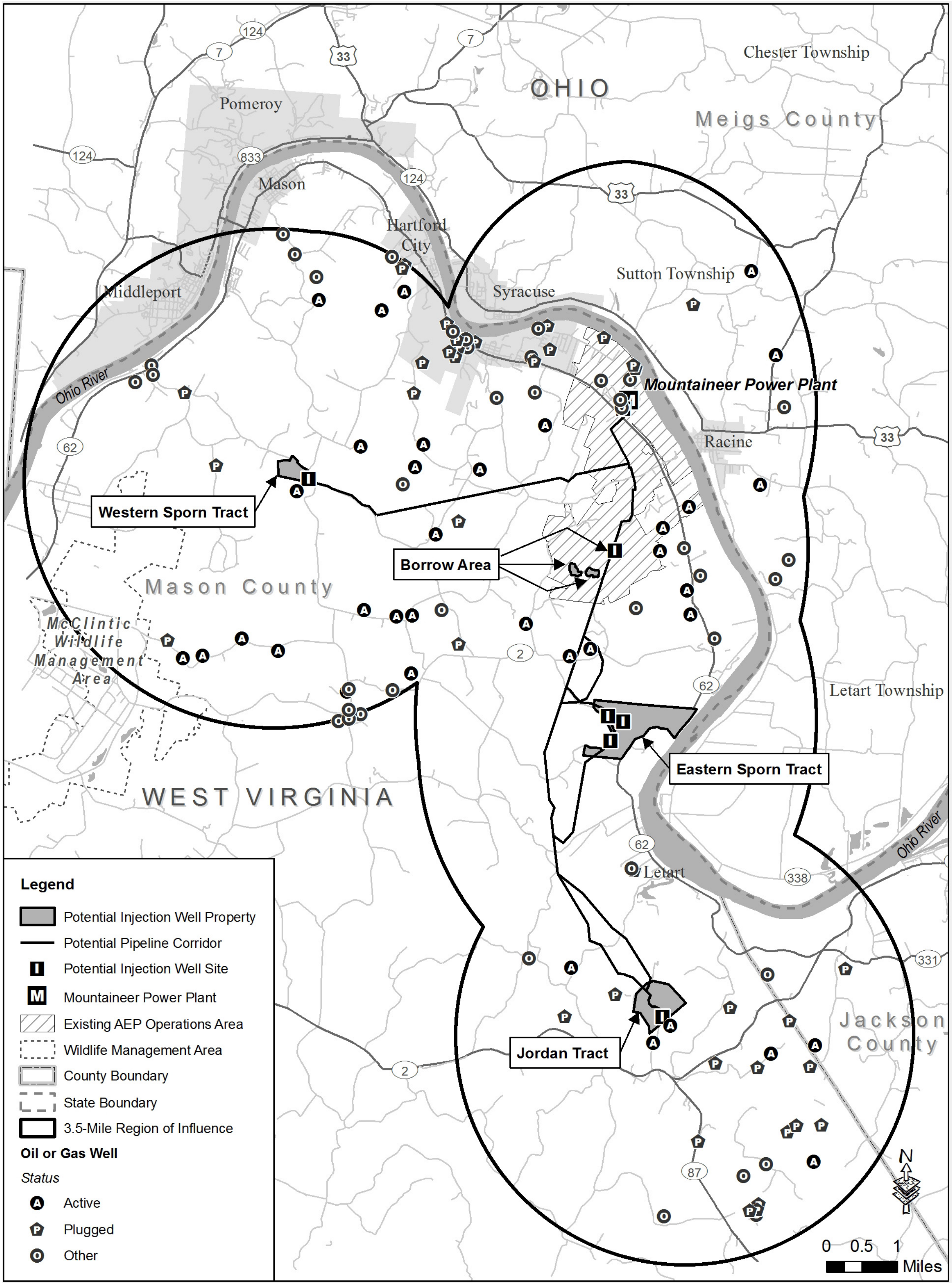

Figure 3.3-3. Oil and Gas Wells within 3.5 Miles of the Potential Injection Well Sites

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).

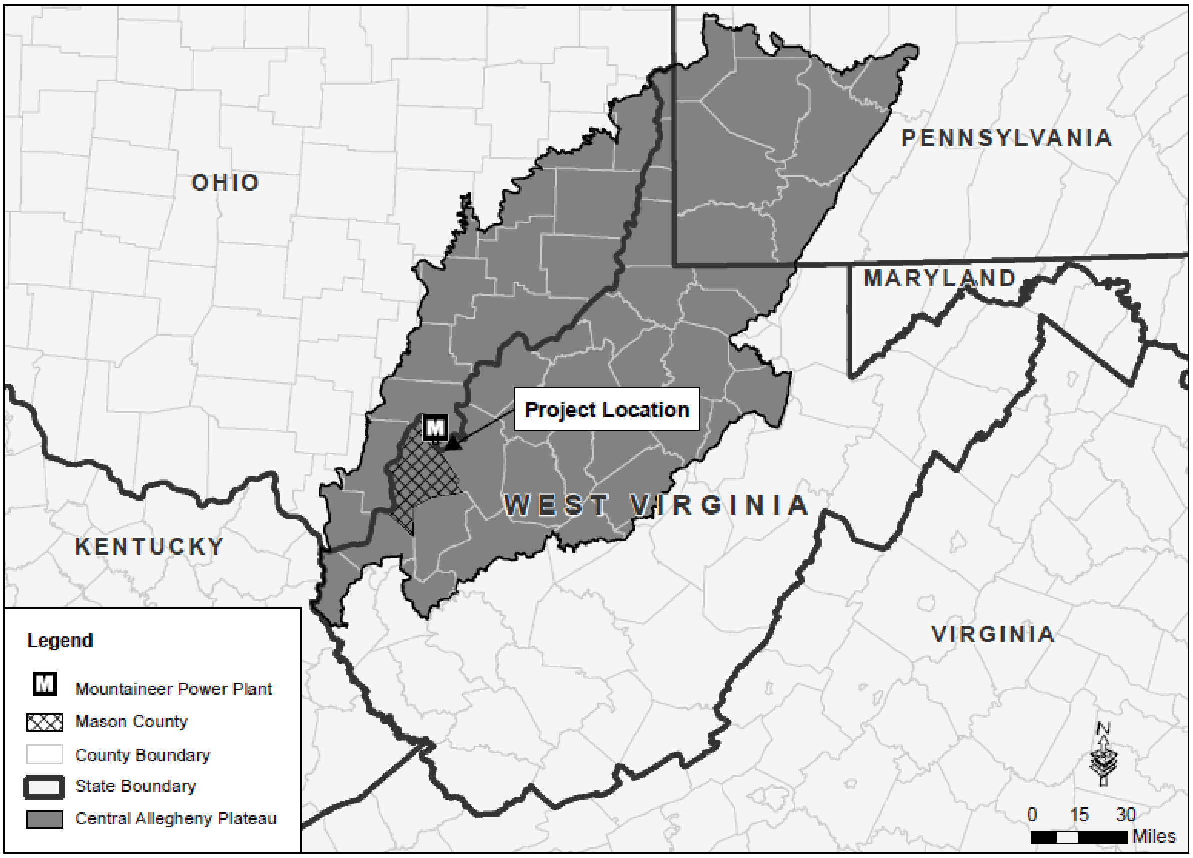

Figure 3.4-1. Central Allegheny Plateau

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).

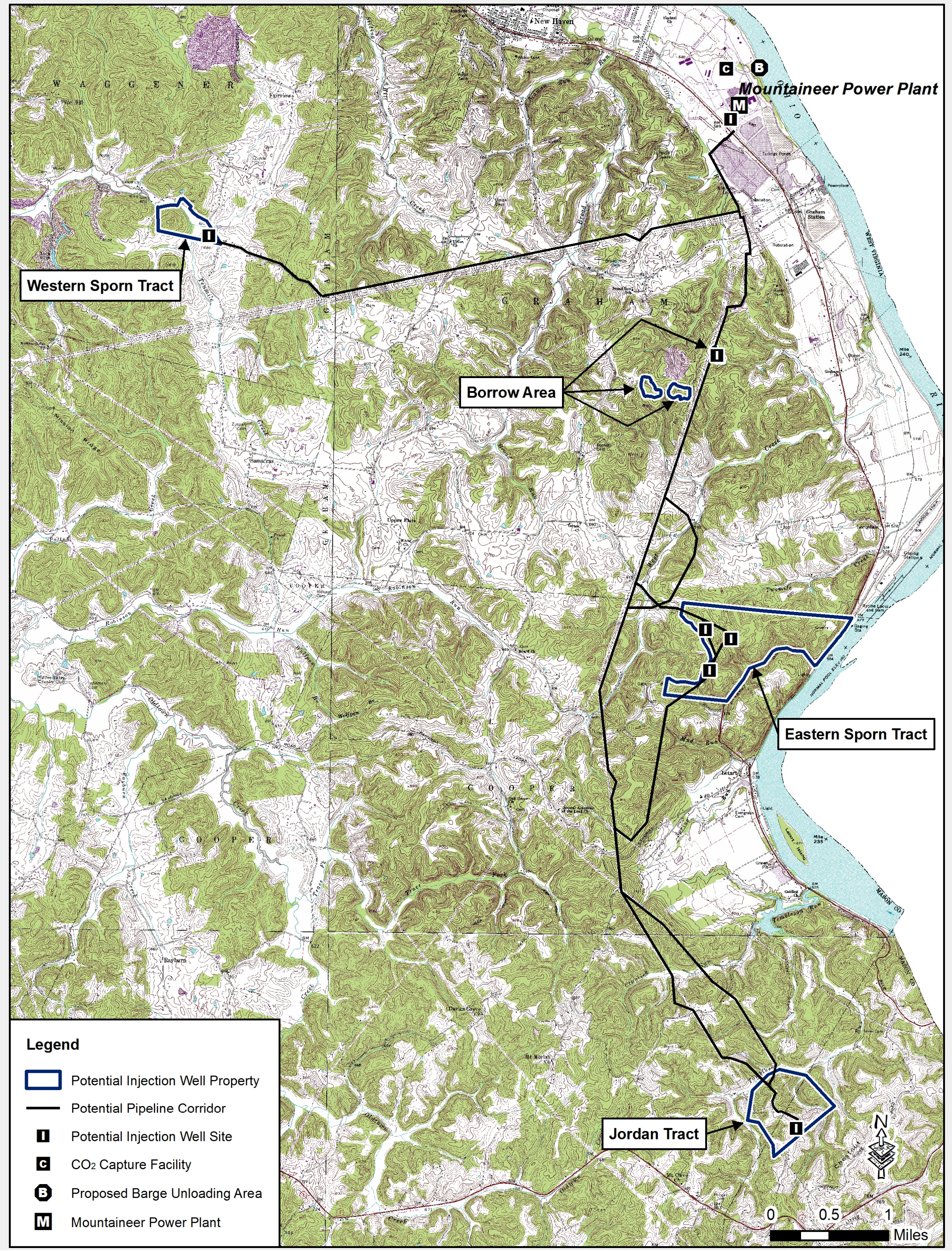

Figure 3.4-2. New Haven, Cheshire, and Mount Alto USGS 7.5-Minute Quadrangle

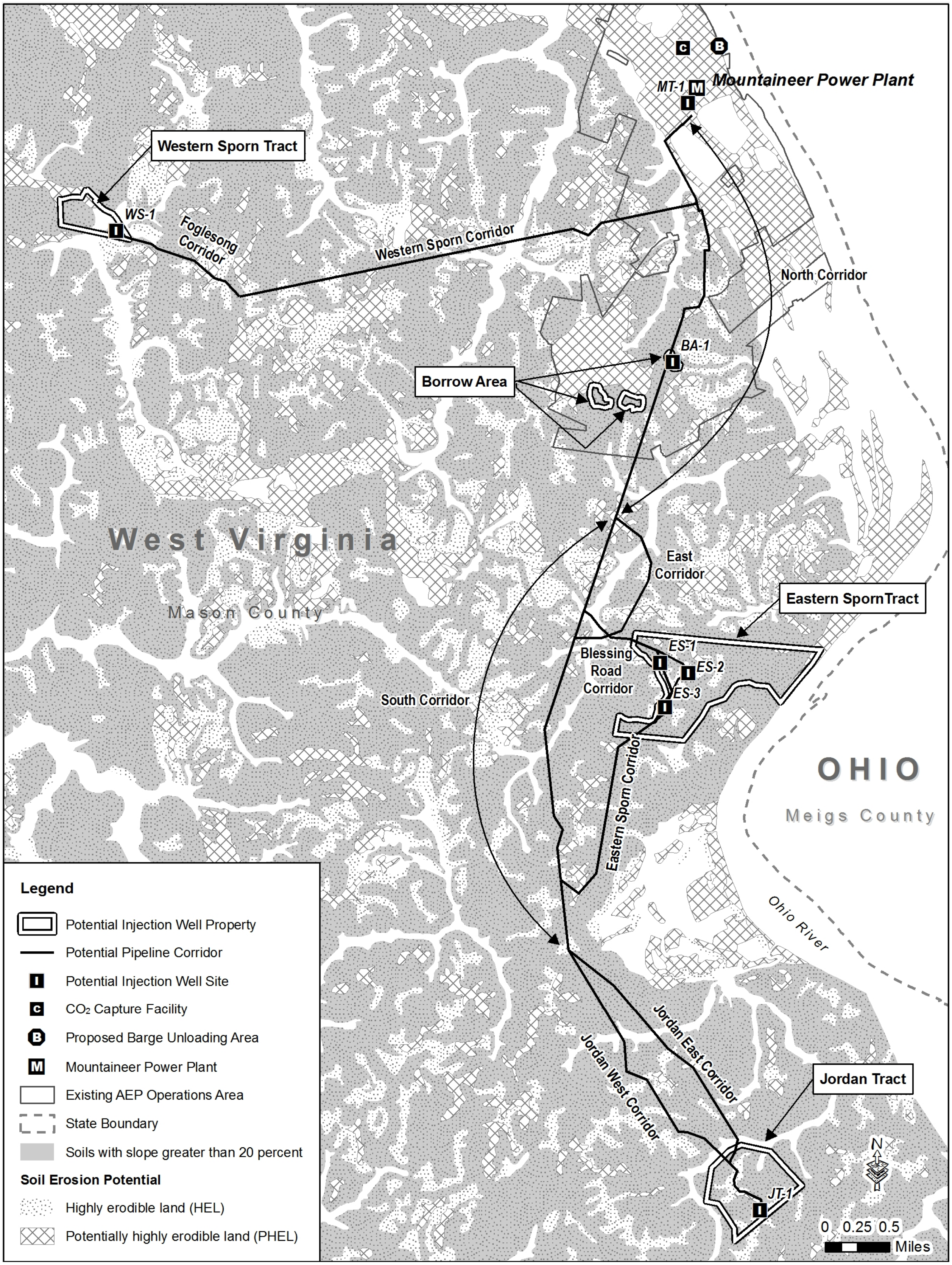

Figure 3.4-3. Soil Erosion Ratings and Slopes Overview

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*.

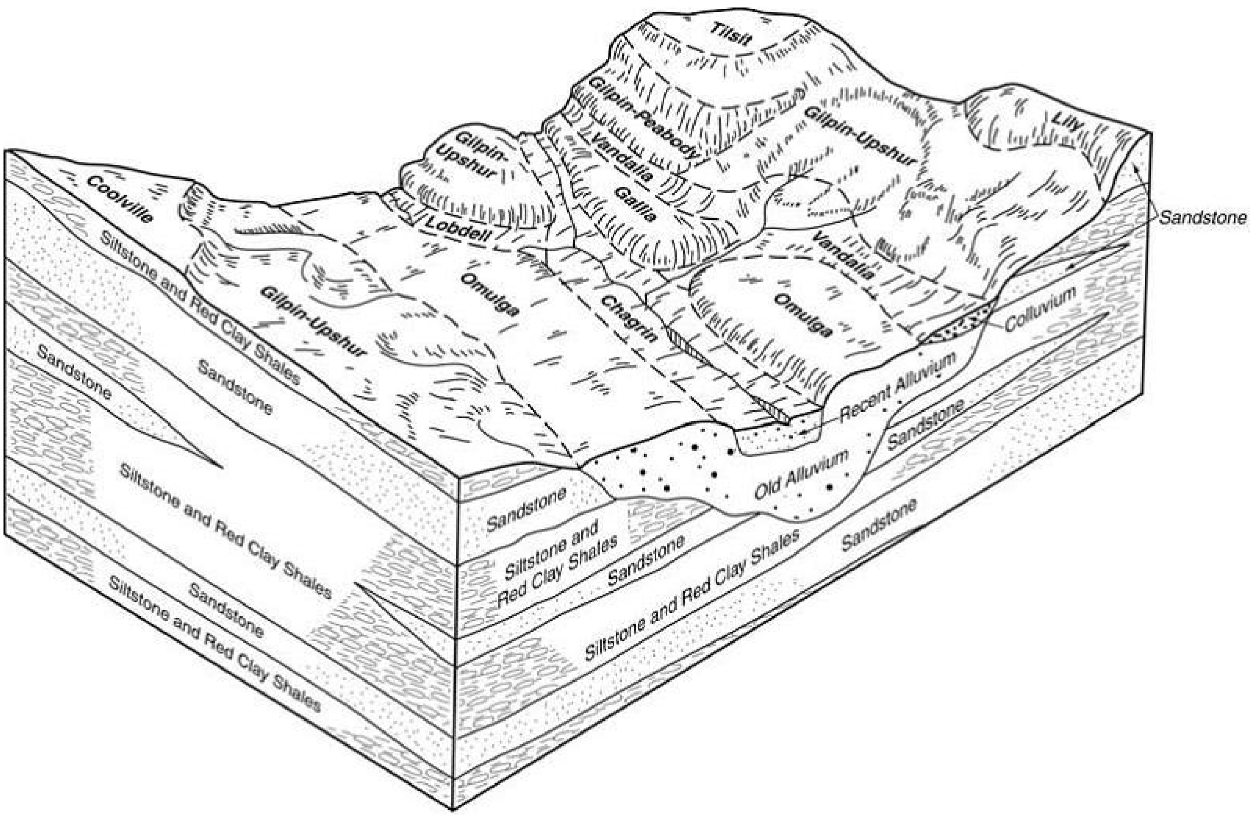

Figure 3.4-4. Diagram Showing Soils Typical of the Mountaineer CCS II Project Area

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

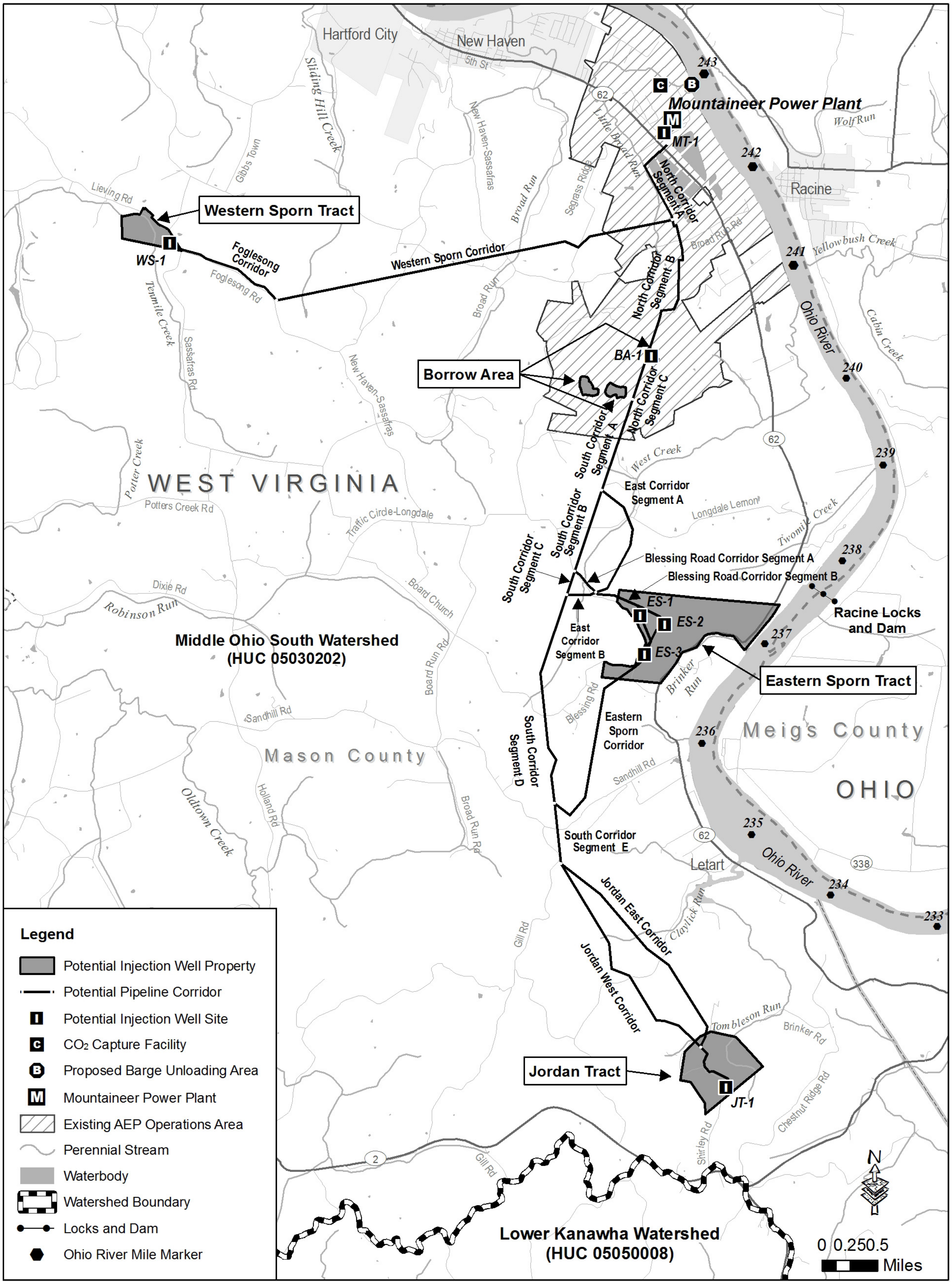

Figure 3.6-1. Surface Water Features in Vicinity of the Project

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

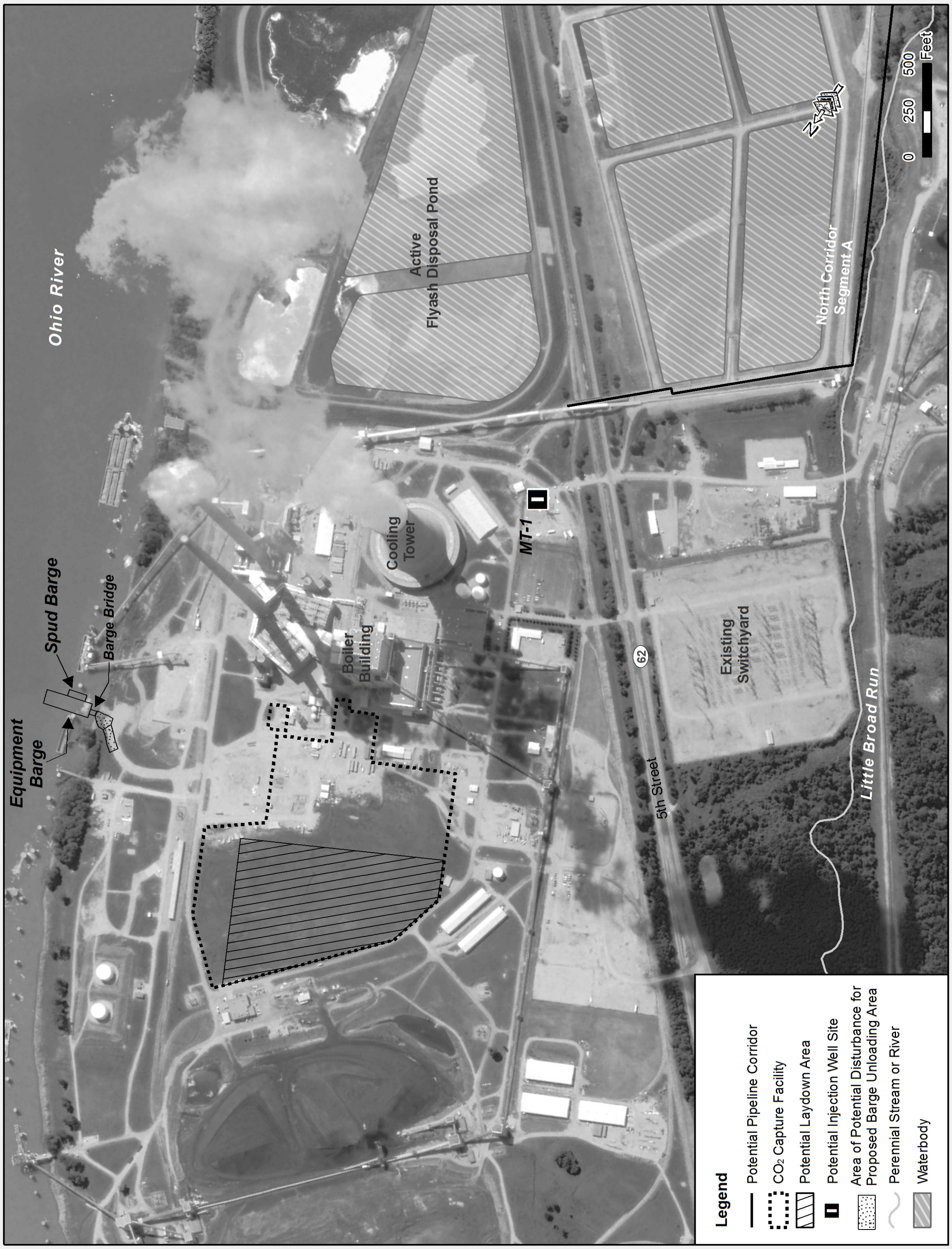

Figure 3.6-2. Surface Water Features near the Mountaineer Plant

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: Loss of Streambed	Increased Turbidity	Degraded Water Quality	Change of Flow Direction	Change of Velocity	Resource Impact Rating
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

Wetlands

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

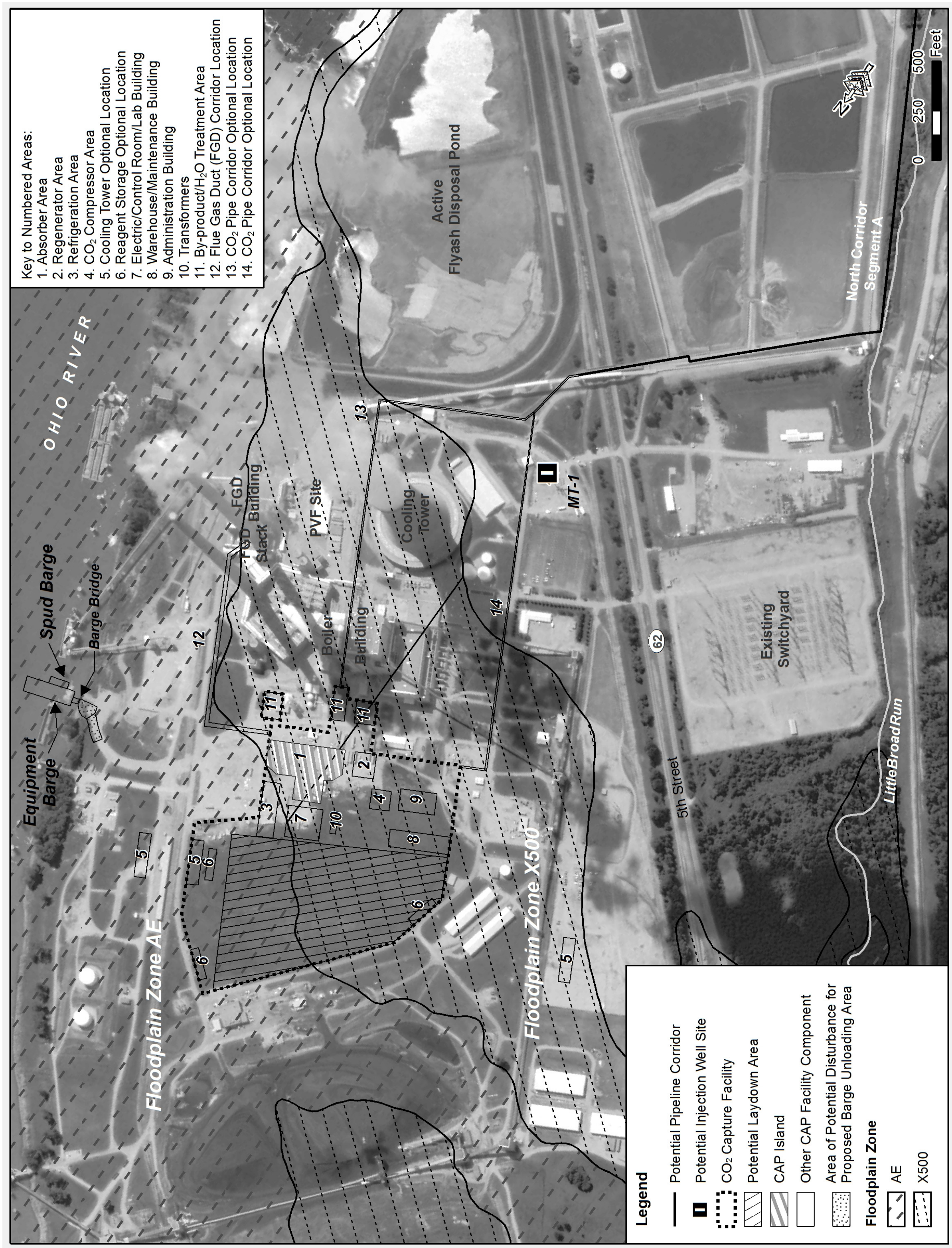

Figure 3.7-1. Floodplains at the Proposed CO_2 Capture Facility

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).

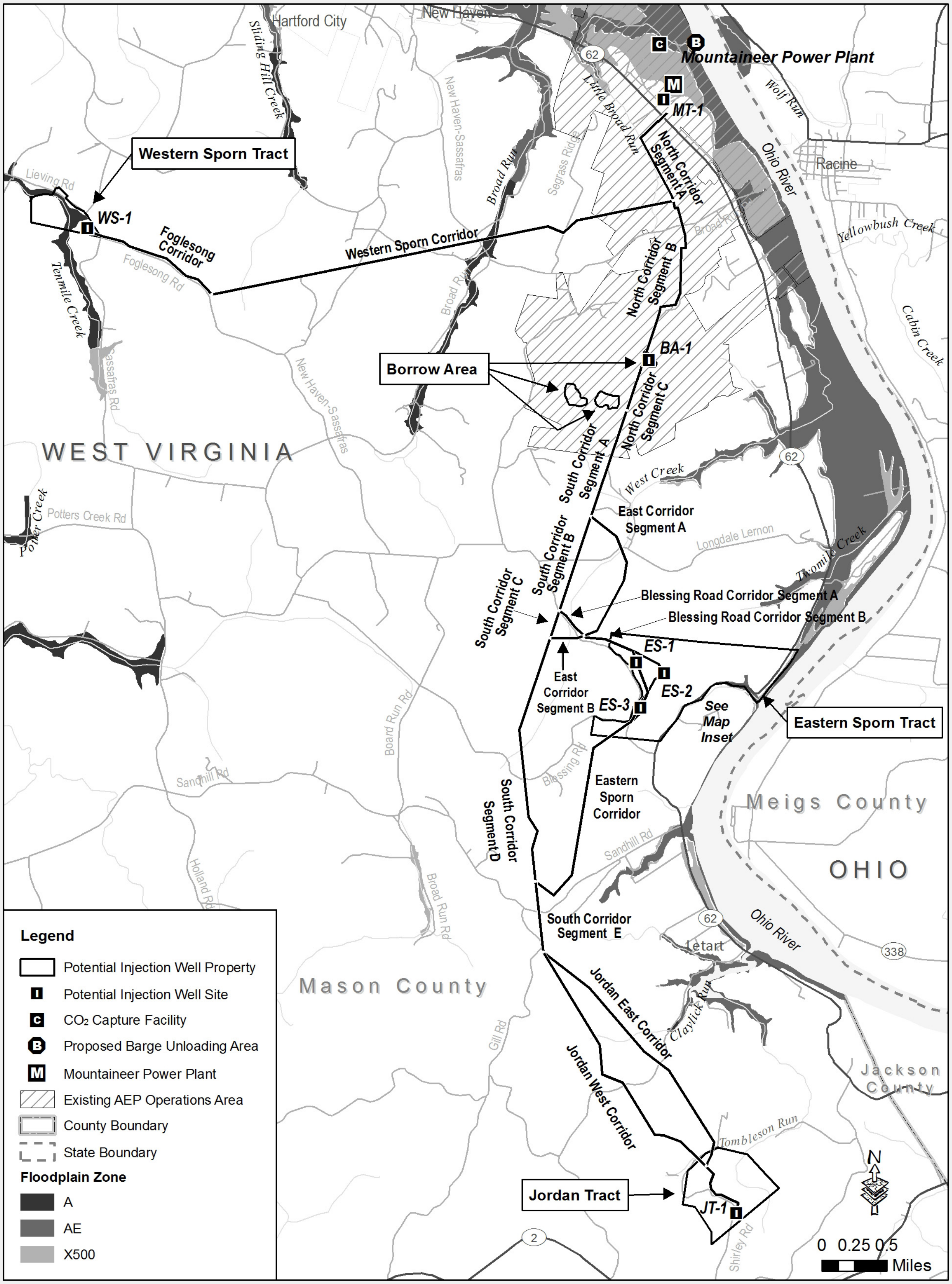

Figure 3.7-2. Floodplains in the Project Area

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*).

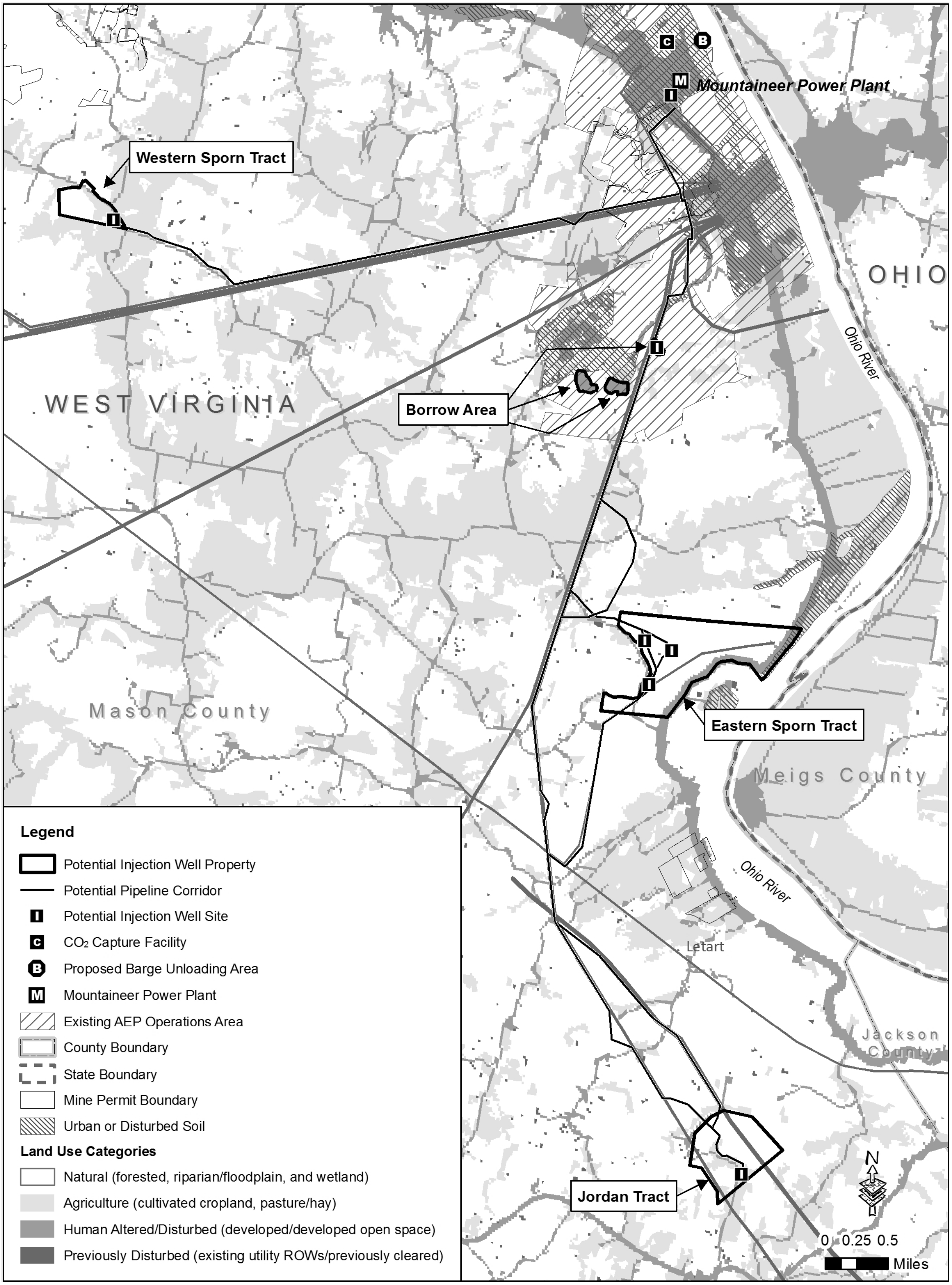

Figure 3.8-1. Land Cover within the Study Area

- **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 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.

> 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]).

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

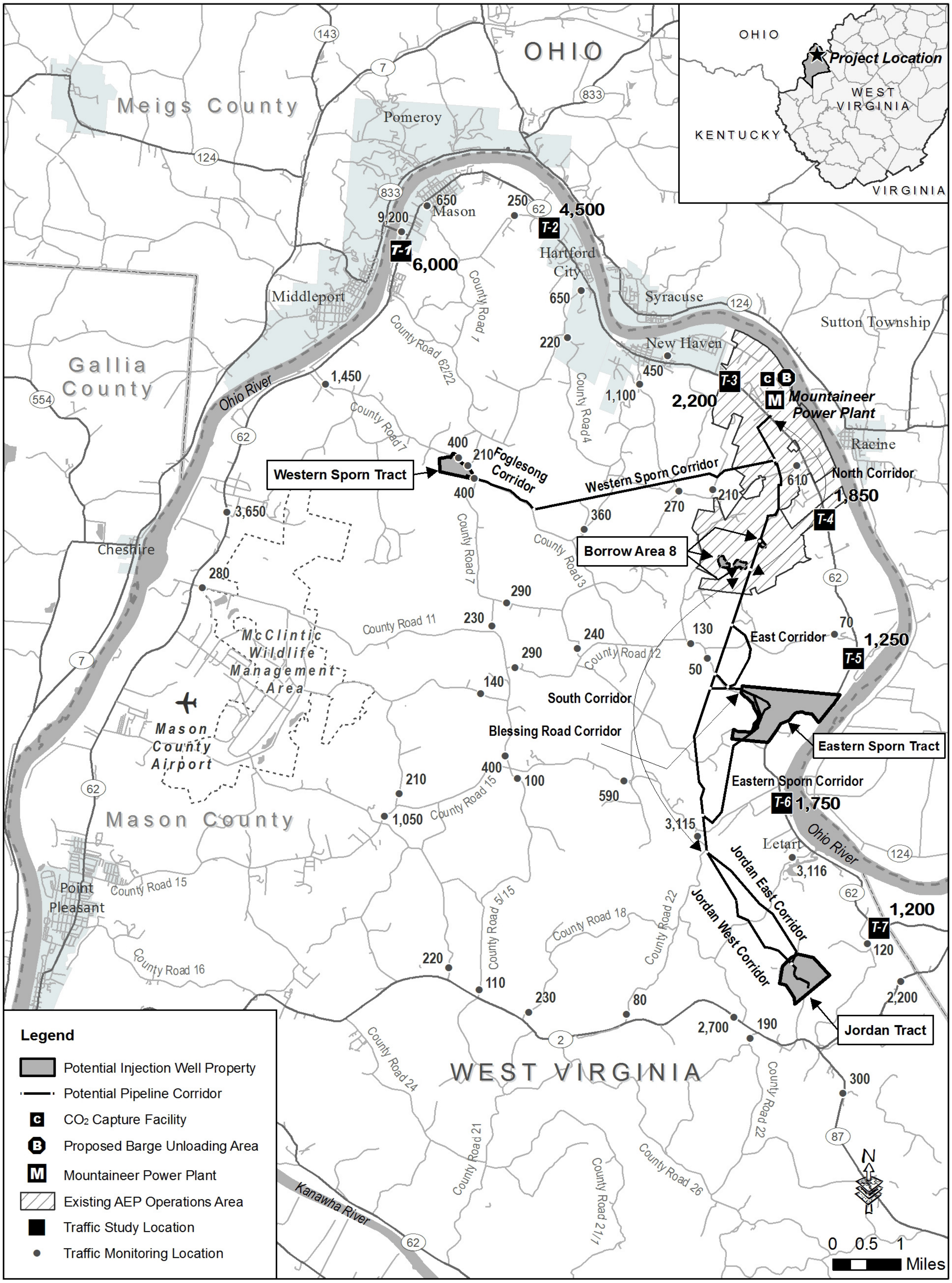

Figure 3.11-2. Average Daily Traffic Volumes in the ROI (WVDOT, 2007)

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.

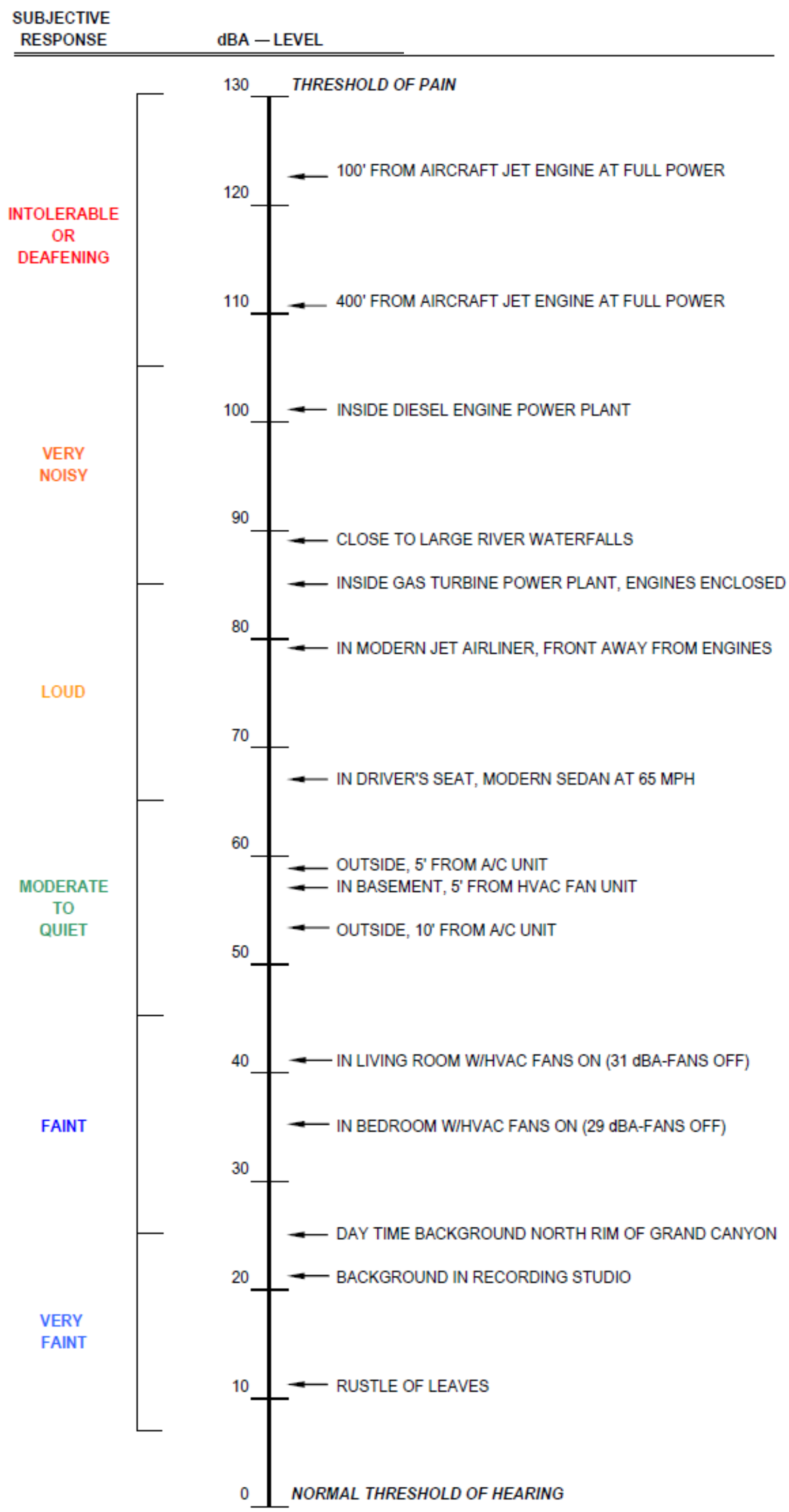

Figure 3.12-1. Decibel Levels for Common Sounds and Subjective Response
Source: Hessler Associates, 2008

- **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

<u>CO_2 Capture Facility</u>

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.

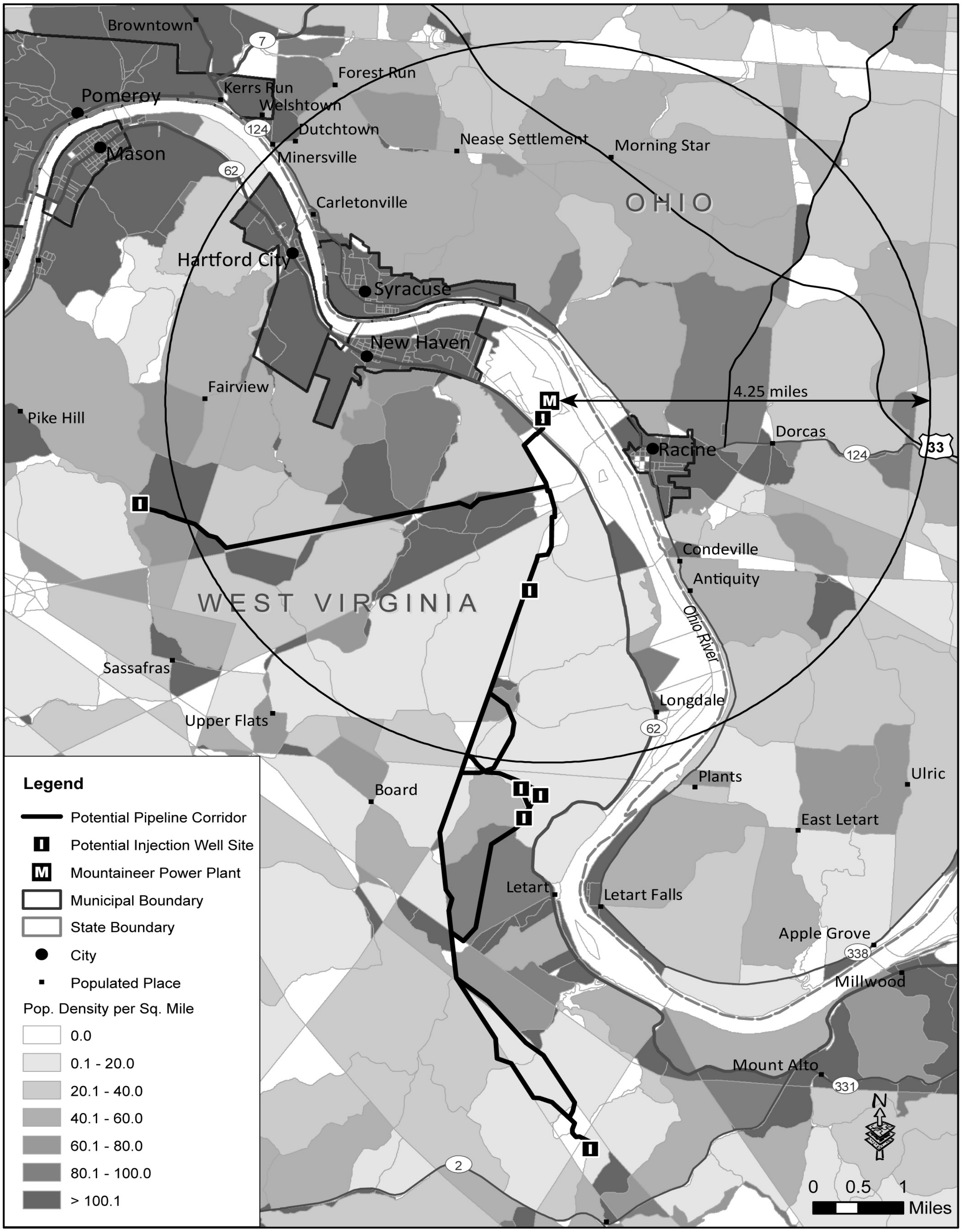

Figure 3.14-1. Population in Vicinity of Potential Pipeline Routes and Injection Wells (2000 U.S. Census)

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 2.2×10^{-6}; loading line failure 5.0×10^{-3}; storage tank failure 9.5×10^{-5}; process line failure 5.3×10^{-4}; and evaporator failure 1.5×10^{-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.