Spire STL Pipeline Project

Draft Resource Report 9
Air and Noise Quality

FERC Docket No. PF16-9-000

Pre-filing draft
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Public

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
SUMMARY OF FILING INFORMATION	
Information	**Found in**
1. Describe existing air quality in the vicinity of the project. (§ 380.12(k)(1)) • Identify criteria pollutants that may be emitted above U.S. Environmental Protection Agency (USEPA)-identified significance levels.	Sections 9.1.2 and 9.1.3.
2. Quantify the existing noise levels (day-night sound level (Ldn) and other applicable noise parameters) at noise sensitive areas and at other areas covered by relevant state and local noise ordinances. (§ 380.12(k)(2)) • If new compressor station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities. • For existing compressor stations (operated at full load), include the results of a sound level survey at the site property line and nearby noise-sensitive areas. • Include a plot plan that identifies the locations and duration of noise measurements. • All surveys must identify the time of day, weather conditions, wind speed and direction, engine load, and other noise sources present during each measurement.	Not applicable.
3. Quantify existing and proposed emissions of compressor equipment plus construction emissions, including nitrogen oxides (NOX) and carbon monoxide (CO), and the basis for these calculations. Summarize anticipated air quality impacts for the project. (§ 380.12(k)(3)) • Provide the emission rate of NO, from existing and proposed facilities, expressed in pounds per hour and tons per year for maximum operating conditions, include supporting calculations, emission factors, fuel consumption rate, and annual hours of operation.	Sections 9.1.3.

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
SUMMARY OF FILING INFORMATION	
Information	**Found in**
4. Describe the existing compressor units at each station where new, additional, or modified compressor units are proposed, including the manufacturer, model number, and horsepower of the compressor units. For proposed new, additional, or modified compressor units include the horsepower, type, and energy source. (§ 380.12(k)(4))	Not applicable.
5. Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure. (§ 380.12(k)(4))	Not applicable.
6. Identify any applicable state or local noise regulations. (§ 380.12(k)(4)) • Specify how the facility will meet the regulations.	Sections 9.2.1.2 and 9.2.1.3.
7. Calculate the noise impact at noise-sensitive areas of the proposed compressor unit modifications or additions, specifying how the impact was calculated, including manufacturer's data and proposed noise control equipment. (§ 380.12(k)(4))	Not applicable.
INFORMATION RECOMMENDED OR OFTEN MISSING	
1. Include climate information as part of the air quality information provided for the project area.	Section 9.1.2.1.
2. Identify potentially applicable federal and state air quality regulations.	Section 9.1.4.
3. Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for proposed pipelines and aboveground facilities.	Section 9.1.3.
4. Provide copies of state and federal applications for air permits.	Not applicable.
5. Provide operational and fugitive emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and aboveground facilities.	Section 9.1.3.6
6. Provide air quality modeling for entire compressor stations.	Not applicable.

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
INFORMATION RECOMMENDED OR OFTEN MISSING	
Information	**Found in**
7. Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	Resource Report 1
8. Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulation facilities, and drilling locations.	Section 9.2.3.
9. Identify any state or local noise regulations applicable to construction and operation of the project	Section 9.2.1.
10. Indicate whether construction activities would occur over 24-hour periods.	Section 9.2.4.
11. Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	Section 9.2.3.
12. Quantify operational noise from aboveground facilities, including blowdowns.	Section 9.2.3 (to be provided in FERC application).
13. Describe the potential for the operation of the proposed facilities to result in an increase in perceptible vibration and how this would be prevented.	Section 9.2.3 (to be provided in FERC application).
14. Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	Resource Report 1.

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Acronyms and Abbreviations

AQCR	Air Quality Control Region
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dBA	"A" weighting frequency scale
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
GWP	global warming potential
HDD	horizontal directional drill
IPCC	Intergovernmental Panel on Climate Change
Leq	Equivalent Sound Level
Ldn	Day-Night Level
Ln	Night Level
M&R	metering and regulating
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NSA	noise sensitive area
NSPS	New Source Performance Standards
$PM_{2.5}$	particulate matter sized 2.5 microns in aerodynamic diameter and smaller
PM_{10}	particulate matter sized 10 microns in aerodynamic diameter and smaller
Project	Spire STL Pipeline Project
scfh	standard cubic feet per hour
SO_2	Sulfur Dioxide
Spire	Spire STL Pipeline LLC

TPY	tons per year
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Air and Noise Quality

9.1 Air Quality

This Resource Report addresses the effects of the Project on the existing air and noise environment and describes proposed measures to mitigate the effects for the Spire STL Pipeline LLC ("Spire") Spire STL Pipeline Project ("Project") within Illinois and Missouri.

9.1.1 Design Basis

Construction of the Project is proposed in Scott, Green, and Jersey Counties, Illinois, and St. Charles and St. Louis Counties, Missouri, and includes approximately 65 miles of pipeline and associated ancillary facilities. No major aboveground facilities are proposed for the Project. The Project will include the construction of three new metering and regulating ("M&R") station interconnects with REX in Illinois and LGC and Enable MRT in Missouri and the construction of a new facility at an existing LGC site along Line 880. The exact arrangement and equipment to be located at these sites has not been finalized and will be provided in the Federal Energy Regulatory Commission ("FERC") application. There are no existing or proposed new compressor stations. Other fuel burning equipment (i.e., pipeline heaters) will be discussed in the FERC application.

9.1.2 Existing Conditions

9.1.2.1 Local Climate

The Project is located in western Illinois just east of and generally runs parallel to the Mississippi River until it crosses the river just north of St. Louis, Missouri which is the nearest large city. This area is flat with the majority of the Project area being located on land in agricultural use in the upper Mississippi River Valley. The climate of this area is best classified as a Mid-latitude Continental which has warm summers and cold winters. Summer temperatures in this area are typically in the upper 80s (degrees Fahrenheit [°F]) while winter temperatures are typically in the lower 40s. Prevailing winds are usually from the northeast. Average annual precipitation totals are approximately 41 inches. There are several surface weather stations located near the Project area all with statistically equivalent data and located in areas with high agricultural use. The St. Charles County Airport located in St. Charles County Missouri was used as the representative station for the Project area. A summary of climate data collected at this station is provided in Table 9.1-1.

9.1.2.2 National Ambient Air Quality Standards

The Clean Air Act of 1970 ("CAA") (Title 42 United States Code § 7401 et seq.) required the United States Environmental Protection Agency ("USEPA") to establish National Ambient Air Quality Standards ("NAAQS") to protect public health and welfare.

Table 9.1-1. Climate Data for St. Charles County Airport, Missouri (1981 to 2010) for the Project

Month	Average Maximum Temperature [degrees Fahrenheit (°F)]	Average Minimum Temperature (°F)	Average Temperature (°F)	Precipitation (inches)
January	39	21	30	2.36
February	44	26	35	2.24
March	55	35	45	3.23
April	67	45	56	3.82
May	76	55	65.5	4.76
June	85	64	74.5	4.29
July	89	68	78.5	4.33
August	88	66	77	3.15
September	80	56	68	3.27
October	68	44	56	3.39
November	55	35	45	3.82
December	42	25	33.5	2.80

Source: United States Climate Data http://www.usclimatedata.com/climate/portage-des-sioux/missouri/united-states/usmo1709

The USEPA has established NAAQS for seven pollutants:

- sulfur dioxide (SO_2);
- carbon monoxide (CO);
- nitrogen dioxide (NO_2);
- inhalable particulate matter (PM) [i.e., PM sized 10 microns in aerodynamic diameter and smaller (PM_{10})];
- fine PM [i.e.; PM sized 2.5 microns in aerodynamic diameter and smaller ($PM_{2.5}$)] excluding regulated precursors for $PM_{2.5}$, which are addressed by their own standards;
- lead; and
- ozone [for which nitrogen oxides (NOx) and volatile organic compounds (VOCs) are regulated as precursors].

Revisions to Section 107 of the CAA in 1977 required the States/Commonwealths and USEPA to identify areas of the country which meet and do not meet the NAAQS. Areas meeting the NAAQS are called "attainment areas," and areas not meeting the NAAQS are called "nonattainment areas." The designation of an area is made on a pollutant-by-pollutant basis.

The USEPA maintains a list of attainment/non-attainment designations for all seven criteria pollutants on their "Green Book" website (USEPA, 2014). The Green Book was used to determine the area designations for the proposed Project area. The USEPA also designates areas where communities that are in close proximity to one another and share a common air quality as Air Quality Control Regions ("AQCRs").

In the Project area there is only one AQCR that has a designation of non-attainment; the Metropolitan St. Louis Interstate AQCR. The Metropolitan St. Louis Interstate AQCR (Missouri-Illinois) consists of the territorial area encompassed by the boundaries of the following jurisdictions:

- In the State of Illinois - Bond County, Clinton County, Madison County, Monroe County, Randolph County, St. Clair County, Washington County.
- In the State of Missouri - Franklin County, Jefferson County, St. Charles County, St. Louis City, St. Louis County.

The Project is located in both St. Charles and St. Louis Counties; otherwise, the rest of the counties in the Project area are designated as being in attainment for all pollutants and are not designated as maintenance areas. This AQCR is designated as non-attainment for both Ozone (Marginal, 8-hour Ozone 2008) and $PM_{2.5}$ (Moderate, $PM_{2.5}$ 1997). Further discussion is provided in Section 9.1.4.2, General Conformity.

Additionally, Jersey County in Illinois was designated as a maintenance area for Ozone in 2012. All of Line 880 and approximately 28.8 miles of the 24-inch pipeline are located within these areas.

Within the Project area, there are several existing, operational monitoring locations collecting data related to criteria pollutants. This information is presented to provide background levels for these criteria pollutants. This data represents the latest, publicly available data from the USEPA and therefore note that it may be raw and unvalidated.

Three active monitoring locations have been identified near the Project area (e.g. within counties where the proposed pipeline would be constructed). These are monitors 29-183-1004 (St. Charles County, Missouri), 29-183-1002 (St. Charles County, Missouri), and 17-083-1001 (Jersey County, Illinois), and are described in Tables 9.1-2, 9.1-3, 9.1-4, and 9.1-5.

9.1.3 Project Emissions

9.1.3.1 Construction Emissions

Construction activities will result in temporary increases in emissions of some pollutants due to the use of non-stationary equipment powered by diesel fuel or gasoline engines; the temporary generation of fugitive dust due to disturbance of the ground surface, vegetation clearing, and other dust generating actions; and indirect

emissions attributable to activities associated with construction activities of the Project (e.g. workers commuting to and from work sites during construction, etc.).

Table 9.1-2. Yearly Local Ozone Data for West Alton Site

Location:	General Electric Store, Highway 94, St. Charles County, Missouri 63386		
Pollutants Monitored:	Active O3		
Status:	Active		
Monitor ID:	29-183-1002		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016	No Data Available		
2015	0.087	0.072	0.070
2014	0.092	0.078	0.072

Source: https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-3. Yearly Local Ozone Data for Orchard Farm Site

Location:	2165 Highway V, St. Charles County, Missouri 63301		
Pollutants Monitored:	Active O3		
Status:	Active		
Monitor ID:	29-183-1004		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016	No Data Available		
2015	0.085	0.078	0.066
2014	0.087	0.740	0.720

Source: https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-4. Yearly Local Ozone Data for Illini Junior High Site

Location:	Liberty Street and County Road, Jersey County, Illinois		
Pollutants Monitored:	Active O3, $PM_{2.5}$		
Status:	Active		
Monitor ID:	17-083-1001		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016 (through 6/7/16)	0.055	0.050	0.042
2015	0.091	0.074	0.067
2014	0.089	0.071	0.065

Source: https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-5. Yearly Local PM2.5 Data for Illini Junior High Site

Location:	Liberty Street and County Road, Jersey County, Illinois		
Pollutants Monitored:	Active O3, $PM_{2.5}$		
Status:	Active		
Monitor ID:	17-083-1001		
Year	**Daily Arithmetic Mean**	**Maximum Daily Mean**	**Fourth Daily Mean**
2016 (through 6/7/16)	7.448	20.0	18.2
2015	7.714	28.7	16.6
2014	10.002	25.5	17.9

Source: https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

These sources are not considered stationary sources and their impacts will generally be temporary and localized. Moreover, the emissions from construction activities are not expected to cause or significantly contribute to an exceedance of the NAAQS.

The installation and construction of the Project is estimated to begin in April 2018 with completion estimated by November 2018. To date, this Project has not been awarded to a contractor and the exact equipment to be used on-site for construction is not known. The equipment anticipated to be used on this Project and the operating hours for each piece of equipment was estimated based upon similar projects of similar size. As such, the emissions provided in Table 9.1-6 are believed to represent a conservative best available estimate of construction

emissions for the Project. Actual emissions from the Project will vary by day and type of construction activity. An estimation of these individual activities (e.g., construction engine emissions and fugitive dust emissions) involving construction of the pipelines has been included in this analysis.

9.1.3.2 Construction Engine Emissions

Construction related emission estimates are based on a typical construction equipment list, hours of operation, and vehicle miles traveled by the construction equipment and supporting vehicles for the Project. This is a conservative estimate based on worst-case assumptions, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, NR-009c (EPA420-P-04-009), April 2004 (Tables 9A-1 and 9A-2 in Appendix 9-A), and the USEPA and Intergovernmental Panel on Climate Change ("IPCC") emission factors (Tables 9A-7 and 9A-8 in Appendix 9-A). Nevertheless, the estimated air emissions from construction of the Project is expected to be transient in nature, with negligible impact on the baseline regional air quality. Construction equipment will be properly maintained and operated only on an as-needed basis to minimize the construction engine emissions. There will also be some emissions attributable to vehicles delivering materials to the construction sites.

Table 9A-1 and Table 9A-2 summarize the estimated emissions of criteria pollutants from construction equipment and PM emissions from material transfers and road traffic, respectively. Emissions from non-road construction equipment engines used during construction were estimated based on the anticipated types of non-road equipment and their associated levels of use. Emission factors in grams per HP-hour were obtained from Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling -- Compression-Ignition. Greenhouse gas emissions where estimated using emission factors from IPCC Guidelines for National Greenhouse Gas Inventories and are summarized in Tables 9A-7 and 9A-8.

9.1.3.3 Fugitive Dust Emissions

Fugitive dust will result from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. The majority of particulate air emissions produced during construction activities will be PM_{10} and $PM_{2.5}$ in the form of fugitive dust. The amount of dust generated will be a function of construction activity, soil type, soil moisture content, wind speed, precipitation, vehicle traffic, vehicle types, and roadway characteristics. Emissions will be greater during dry periods and in areas of fine textured soils subject to surface activity. Potential PM emissions from material transfers, wind erosion, and unpaved/paved road were estimated using USEPA's AP-42 emissions factors. An estimation of fugitive emissions for the Project is provided in Tables 9A-3 through 9A-6 provided in Appendix 9-A of this report.

Spire will employ proven construction-related practices to control and limit releases of fugitive dust, including the application of water or other commercially available dust control agents on unpaved areas subject to frequent vehicle traffic in accordance with the Fugitive Dust Control Plan for the Project in Appendix 9-C. In addition, construction equipment will only be operated on an as needed basis.

Table 9.1-6. Summary of Temporary Construction Emissions

Description	Criteria Pollutants [tons per year (TPY)]						GHGs[1] (TPY)			CO_2 Equivalent (metric tonnes)[1]
	PM_{10}	Carbon Dioxide (CO_2)	Nitrous Oxide (N_2O)	CH_4	SO_2	NOx	CO_2	N_2O	CH_4	
Off-Road Engines - 24-Inch Pipeline	6.9	6.7	12.6	45.9	0.08	126.8	3,075.5	0.2	1.2	2,861.1
Off-Road Engines - Line 880	0.8	0.7	1.4	5.0	0.01	13.1	321.3	0.0	0.1	298.9
Unpaved Roads - 24-Inch Pipeline	10.1	1.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Unpaved Roads - Line 880	1.8	0.2	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Material Handling and Wind Erosion - 24-Inch Pipeline	1.0	0.1	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Material Handling and Wind Erosion - Line 880	0.3	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Total Pipeline Emissions	**20.8**	**8.8**	**14.0**	**50.9**	**0.09**	**139.9**	**3,396.8**	**0.2**	**1.3**	**3,160.0**
Total Pipeline Emissions Non-Attainment and Maintenance Areas[2]	**11.8**	**4.9**	**7.7**	**28.0**	**0.05**	**76.7**	**1,864.4**	**0.1**	**0.7**	**1,734.4**

Notes:

[1] Greenhouse gas emissions were adjusted for global warming potential ("GWP"), using GWP factors of 310 for N_2O and 21 for methane ("CH_4"). Additionally, greenhouse gas emissions were converted from short tons to metric tonnes.

[2] All of Line 880 is located in the Metropolitan St. Louis Interstate AQCR. 13.0 miles of the 24-inch pipeline is located in the Metropolitan St. Louis Interstate AQCR; 15.8 miles of the 24-inch pipeline is located with Jersey County, Illinois which is a maintenance area for ozone. Emission estimates for the 24-inch pipeline are calculated based on this mileage.

9.1.3.4 Open Burning Emissions

Spire is not proposing open burning as a means of disposing of land clearing waste during construction.

9.1.3.5 Stationary Source Emissions

There are no proposed stationary point sources associated with the Project. No specific permits for stationary point sources are required.

9.1.3.6 Fugitive Emissions of Methane

Conservatively, anticipated operational fugitive emissions for the proposed pipeline of methane can be estimated as shown in Table 9.1-7.

Table 9.1-7. Methane to Carbon Dioxide Equivalent for Pipelines

Source	Length of Pipeline		Emission Factor (Gg CH_4/km)	Criteria Pollutants (metric tons per year)[1]	
	miles	km		CH_4	CO_2e
Pipeline Emissions	58	93.32	3.70E-03	345.29	8,286.99

Source: IPCC's Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories Section 2.2.2, Table 3.

Note:

[1] Tons CH_4 converted to Tons CO_2e by multiplying by 24.

These fugitive emissions come from a variety of sources including connections and line segment blowdowns.

For the Project, engineering design and operational measures will be evaluated to minimize fugitive and episodic CH_4 emissions. These measures represent the most efficient design with the least environmental impact while providing reliable pipeline operation. These measures include:

- pumping down the pressure of lines to as low a pressure as possible using inline compression prior to blowdown for maintenance; and
- installing low leak fugitive components, where practicable

9.1.3.7 Greenhouse Gas Mandatory Reporting Rule

The GHG Mandatory Reporting Rule, at 40 CFR Part 98 (Subpart W), requires certain facilities that emit 25,000 metric tons or more of CO_2 per year to report annual emissions of specified GHGs from various processes within the facility and conduct associated monitoring. Onshore natural gas transmission pipeline industry segments are included in this requirement only if they emit 25,000 metric tons per year or more of emissions from activities under §98.232(m). This relates to pipeline blowdown CO_2 and CH_4 emissions from blowdown vent stacks.

Based on Table 9.1-2 in Section 9.1.3.6 of this report, this Project will not result in emissions equal to, or in excess of, this threshold. Therefore, the Greenhouse Gas Mandatory Reporting Rule does not apply.

9.1.4 Regulatory Requirements for Air Quality

The provisions of the CAA that are potentially applicable to construction and operation of the new facilities associated with the Project are:

- New Source Performance Standards ("NSPS");
- State Regulations; and
- Conformity of General Federal Actions.

Provisions under the New Source Review permitting program National Emission Standards for Hazardous Air Pollutants, Green House Gas Mandatory Reporting Rule, and the Title V Operating Permit program are not applicable to the Project. The following is a brief description of the potentially applicable regulations and their requirements.

9.1.4.1 NSPS

NSPS in 40 Code of Federal Regulations ("CFR") Part 60 regulate emissions from new emissions sources from specific source categories. The majority of the source categories cover emission sources that are not associated with the equipment being installed as part of the Project; however, recent updates to Subpart OOOO - Crude Oil and Natural Gas Production Transmission and Distribution) know as Subpart OOOOa do potentially apply.

Subpart OOOOa - Standards of Performance for Crude Oil and Natural Gas: Production, Transmission, and Distribution

On August 18, 2015, USEPA proposed amendments to 40 CFR 60, Subpart OOOO and proposed an entirely new Subpart OOOOa, which was published to the Federal Register on September 18, 2015. On May 16, 2016 USEPA finalized this new subpart; therefore, Subpart OOOOa will apply to oil and natural gas production, transmission, and distribution affected facilities that are constructed, reconstructed, and modified after the Federal Register date of September 18, 2015. The proposed NSPS Subpart OOOOa would establish standards for both VOC and CH_4. In all cases, natural gas is used as a surrogate for both CH_4 and VOC. OOOOa will affect additional sources at the proposed facilities beyond Subpart OOOO. Many of these requirements of this subpart are applicable to natural gas processing plants and compressor stations. However, continuous bleed natural gas-driven pneumatic controllers that are located on a natural gas transmission systems are limited to a natural gas bleed rates of 6 standard cubic feet per hour ("scfh"). However, the rule does the allow for the use of a natural gas bleed rate greater than 6 scfh if it can be demonstrated that the functional needs of the control are required due to but not limited to response time, safety and positive actuation. For continuous bleed natural gas-driven pneumatic controllers that seek to make this justification there are tagging and record keeping requirements.

At this time design of the pipeline components is still in process and it is unknown if there will be any pneumatic controls that are applicable to this requirement. Once the design is closer to final, Spire will evaluate the applicability of this requirement.

9.1.4.2 General Conformity

Section 176 of the 1990 CAA Amendments required the USEPA to promulgate rules to make certain Federal actions conform to the applicable State Implementation Plan. These rules, known together as the General Conformity Rule (40 CFR 93, Subpart B), require any Federal agency responsible for an action in a non-attainment or maintenance area for any criteria pollutant to determine if the action conforms with the applicable State Implementation Plan or is exempt from the General Conformity Rule requirements.

The USEPA amended the General Conformity rule in 2010 (Federal Register, Volume 75, Number 64, April 5, 2010). As amended, emissions regulated by a permit issued under minor or major NSR are exempted from a General Conformity applicability analysis. Previously, only major NSR permit emissions were excluded.

General Conformity currently applies to areas designated as non-attainment or maintenance for ozone under the 1997 and 2008 8-hour ozone NAAQS. To remove the complexity of having to address requirements under two ozone NAAQS, the USEPA published the "Implementation of the 2008 NAAWS for Ozone: State Implementation Plan Requirements - Proposed Rule" in the Federal Register on June 6, 2013.

The proposed rule provides that all requirements, including General Conformity, will not apply to areas designated as non-attainment or maintenance for the 1997 ozone NAAQS when that NAAQS is revoked. The 1997 ozone NAAQS will be revoked upon publication of the final rule. The public comment period for the proposed rule ended August 5, 2013 and the final rule has not been promulgated to date. Until the USEPA publishes the final rule, requirements to address General Conformity under the 1997 8-hour ozone NAAQS continue to apply alongside the 2008 8-hour ozone NAAQS.

A General Conformity analysis consists of two steps. The first step is an applicability analysis where estimated Project emissions from construction and operation (with emission sources covered by a permit excluded) are compared to de minimis thresholds defined in the General Conformity Rule. Step two, a General Conformity determination, is required for each pollutant where the total of direct and indirect emissions caused by a Federal action (such as a FERC action) would equal or exceed de minimis levels as specified in 40 CFR Part 93.153 with the exceptions specified in 40 CFR Part 51.853(c), (d), or (e). General Conformity does not apply to Federal actions in attainment areas or unclassifiable/attainment areas.

For ozone non-attainment areas, emissions of VOC and NOx are evaluated because they are precursor pollutants to ozone formation. For $PM_{2.5}$ non-attainment areas, emission of NOx and SO_2 are evaluated (in addition to direct $PM_{2.5}$) because they are precursor pollutants to $PM_{2.5}$ formation. Project activities in Counties belonging to the same non-attainment area or area under maintenance are assumed to contribute cumulatively to the non-attainment or maintenance area. During the applicability analysis, estimated emissions within non-attainment and maintenance areas are compared against preset threshold levels per 40 CFR Section 93.153. The applicability thresholds vary, depending on the severity of the non-attainment area. De minimis emissions are

total direct and indirect emissions of a criteria pollutant caused by a Federal action in a non-attainment or maintenance area at rates less than the specified applicability thresholds. These thresholds are presented in Table 9.1-8.

Table 9.1-8. General Conformity Thresholds

Pollutant/Non-Attainment Area	TPY
Ozone (VOCs or NOx)	
Serious Non-Attainment Areas	50
Severe Non-Attainment Areas	25
Extreme Non-Attainment Areas	10
Other Ozone Non-Attainment Areas outside an Ozone Transport Region	100
Other Ozone Non-Attainment Areas inside an Ozone Transport Region	
VOC	50
NOx	100
CO_2 (all non-attainment areas)	100
SO_2 or NO_2 (all non-attainment areas)	100
PM_{10}	
Moderate Non-Attainment Areas	100
Serious Non-Attainment Areas	70
$PM_{2.5}$	
Direct Emissions	100
SO_2	100
NOx (unless determined not to be a significant precursor)	100
VOC or Ammonia (if determined to be significant precursors)	100
Lead (all non-attainment areas)	25

Source: 40 CFR §93.153

The emissions for the Project are below these thresholds, as previously shown in Table 9.1-6. For example, the AQCR is designated as “Other ozone non-attainment areas outside an Ozone Transport Region” for Ozone, thus the General Conformity Thresholds for VOC and NOx are 100 TPY. The estimated VOC emissions for the non-attainment area (from Table 9.1-6) are 7.7 TPY. The NOx emission for the non-attainment area are 76.7 TPY. The

General Conformity Thresholds for $PM_{2.5}$ are 100 TPY. The $PM_{2.5}$ emission estimate for the non-attainment area (from Table 9.1-6) is 4.9 TPY.

9.1.4.3 Air Quality Modeling Analysis

There are no stationary point sources proposed as part of the Project; therefore, an air quality modeling analysis is not provided as part of this resource report.

9.2 Noise Quality

The unit of noise measurement is the decibel (“dB”), which measures the energy of the noise. Because the human ear is not uniformly sensitive to noise frequencies, the "A" weighting frequency scale (“dBA”) was devised to correspond with the ear's sensitivity. The dBA uses specific weighting of a sound pressure level for the purpose of determining the human response to sound and the resulting unit of measure is the dBA.

Because noise levels can vary over a given time period, they are further quantified using the Equivalent Sound Level (“Leq”), Night Level (“Ln”), and Day-Night Level (“Ldn”). The Leq is an average of the time-varying sound energy for a specified time period. The Ln is an average of the time-varying sound energy for the time period between 10 p.m. and 7 a.m. local time. The Ldn is an average of the time-varying sound energy for one 24-hour period, with a 10 dB addition to the sound energy for the time period of 10 p.m. to 7 a.m. local time. If the sound energy does not vary with time, the Ldn level will be equal to the Leq level plus 6.4 dBA.

The Project will also include the construction of three metering and regulating (“M&R”) station interconnects with REX in Illinois and LGC and Enable MRT in Missouri and the modification of an existing facility along Line 880. Spire plans to conduct baseline noise surveys at each facility.

9.2.1 Regulatory Requirements for Noise

9.2.1.1 Federal Noise Regulations

The USEPA has identified a noise level of 55 dBA as being the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas, with an adequate margin of safety (USEPA, 1971). The FERC guidelines (18 CFR Part 157.206-[b][5][i] and [ii]) require that the noise attributable to new compressor engines or modification not exceed an Ldn of 55 dBA at the nearest noise sensitive area (“NSA”) (schools, hospitals, or residences) unless such NSAs are established after facility construction. In addition, the FERC typically requires that the noise attributable to the full load operation of a compressor station, including the compressor unit addition, should not exceed the previously existing noise levels produced by the compressor station at nearby NSAs that are above an Ldn of 55 dBA.

For horizontal directional drill (“HDD”) boring operations, the FERC guidelines (18 CFR Part 157.206-[b][5][iii]) require that the noise attributable to HDD not exceed an Ln of 55 dBA at the nearest NSAs unless such NSAs are established after facility construction.

9.2.1.2 State Noise Regulations

A preliminary review of local noise ordinances for the areas where the HDD operations and M&R facilities will be conducted has resulted in the following assessment of noise level regulations for the area. This review should not be considered exhaustive, constituting publicly available information on the websites of the counties in question.

9.2.1.3 Illinois/Missouri State Ordinances

No state specific noise ordinances pertaining to HDD operations were found for either state.

9.2.1.4 Local/County Noise Regulations

Scott County, Illinois

There is a proposed M&R facility located in this county. Spire is in the process of coordinating with the county.

Jersey County, Illinois

There is a proposed HDD entrance/exit location located in this county. This location is to the north of the Mississippi River.

No publicly available noise ordinance for Jersey County was found. Spire is currently in the process of coordinating with the county.

St. Charles County, Missouri

There is a proposed HDD entrance/exit location located in this county to the north of the Missouri River and a second HDD entrance/exit location located in this county to the south of the Mississippi River.

This county restricts noise levels from portable or motor vehicle audio equipment and public address systems. Spire is currently in the process of coordinating with the county.

St. Louis County, Missouri

There is a proposed HDD entrance/exit location and three M&R facilities located in this county. The location of the HDD is to the south of the Missouri River.

There is a general noise ordinance for St. Louis County, Missouri. This ordinance generally states that, “It is also unlawful to speak, shout, sing, or create any noise at a volume that disturbs the peace of another person.” Spire is currently in the process of coordinating with the county.

9.2.2 Noise Level Impacts

The Project includes two HDD entrance, two HDD exit locations, and four M&R facilities. One HDD will cross under the Mississippi River, and one will cross under the Missouri River.

There are no new or modified compression facilities associated with this Project.

9.2.3 Noise Impacts

Although pipeline construction activities may cause some noise impact during construction, this impact will be limited to the relatively short period of active construction. The Project is not expected to result in a significant or long-term disturbance in construction of the pipeline in the Project area.

HDD operations generally consists of an HDD drilling rig and auxiliary support equipment, including mud pumps, portable generators, cranes, mud mixing and cleaning equipment, fork lifts, loaders, trucks, and portable light sets. Much of the equipment will likely be staged at the HDD entry point. The sound level impacts at NSAs associated with the HDD entry and exit sites will depend on the drilling contractor and type of equipment used, the mode of operation of the equipment, the length of time the equipment is in use, the amount of equipment used simultaneously, and the distances between sound sources and sensitive sites.

The impacts of the construction and/or modification of the M&R stations will be evaluated. M&R stations typically include a fenced control building and a permanent access road. They also include a supply line and a discharge line from the associated pipeline, an emergency bypass line, and communication equipment for supervisory control.

The locations of the NSAs preliminarily identified nearest to the proposed HDD entry and exit points are shown on Figures 9.2-1 and 9.2.2. The locations of the entry point and exit point for the HDD is preliminary based on initial evaluation of site features. The HDD location may be modified based on the collection of further site characterization data and during the engineering design phase. The anticipated noise impacts from the HDD operations will be analyzed and where necessary proposed means to control construction noise from HDD operations will be established once the design has been finalized and the distances to NSAs can be established.

A general description of NSAs near each HDD location based on a desktop review of each location and as shown on Figures 9.2-1 and 9.2-2 is provided as follows:

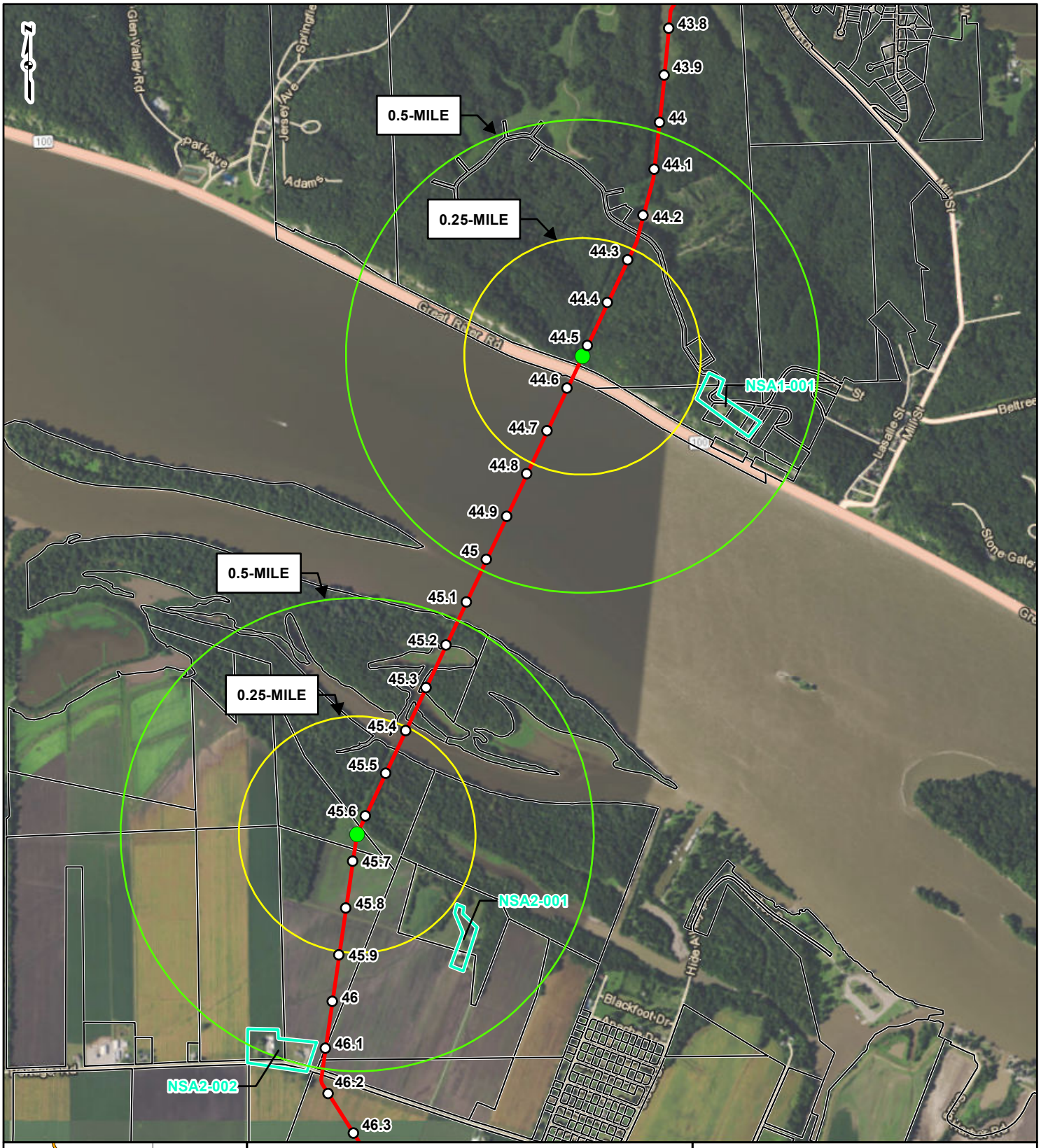
- There are residences to the west of the HDD location south of the Missouri River, and an existing quarry to the east of this location.
- There are isolated residences and farmlands north of the HDD location on the north side of the Missouri River.
- To the south of the Mississippi river crossing, there are residences and farmlands to the south.
- To the north of the Mississippi river crossing, there are residences to the east.

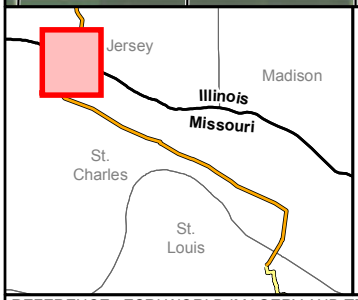
Spire proposes to field view the HDD entry/exit locations and the NSAs within a one-half-mile radius of the drill locations, and to conduct ambient sound level monitoring at identified NSAs for each of the two selected HDD locations. Spire will monitor sound level and establish two sets of 15-minute averages at each location using a Bruel & Kjaer Model 2000 sound monitor (or equivalent).

Spire is evaluating the NSA's at the M&R facilities, and further information will be provided in the FERC application.

An acoustical analysis will be performed to determine the estimated noise contribution at each NSA using SoundPLAN® acoustical modeling software, or equivalent. Baseline noise survey results and noise impact calculation results will be presented in Appendix 9-B in the FERC application.

Figure 9.2-1. Delineated Noise Sensitive Areas - Mississippi River





LEGEND

- MILEPOST
- HDD LOCATION
- 24-INCH PIPELINE
- LINE 880 MODIFICATIONS
- NOISE SENSITIVE AREA
- 0.25- MILE HDD RADIUS
- 0.50- MILE HDD RADIUS
- PARCEL BOUNDARY

0 750 1,500 3,000 Feet

NOISE SENSITIVE AREAS

SPIRE STL PIPELINE PROJECT

gai consultants

spire

DRAWN BY: PMH DATE: 10/14/2016
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 10/2016.

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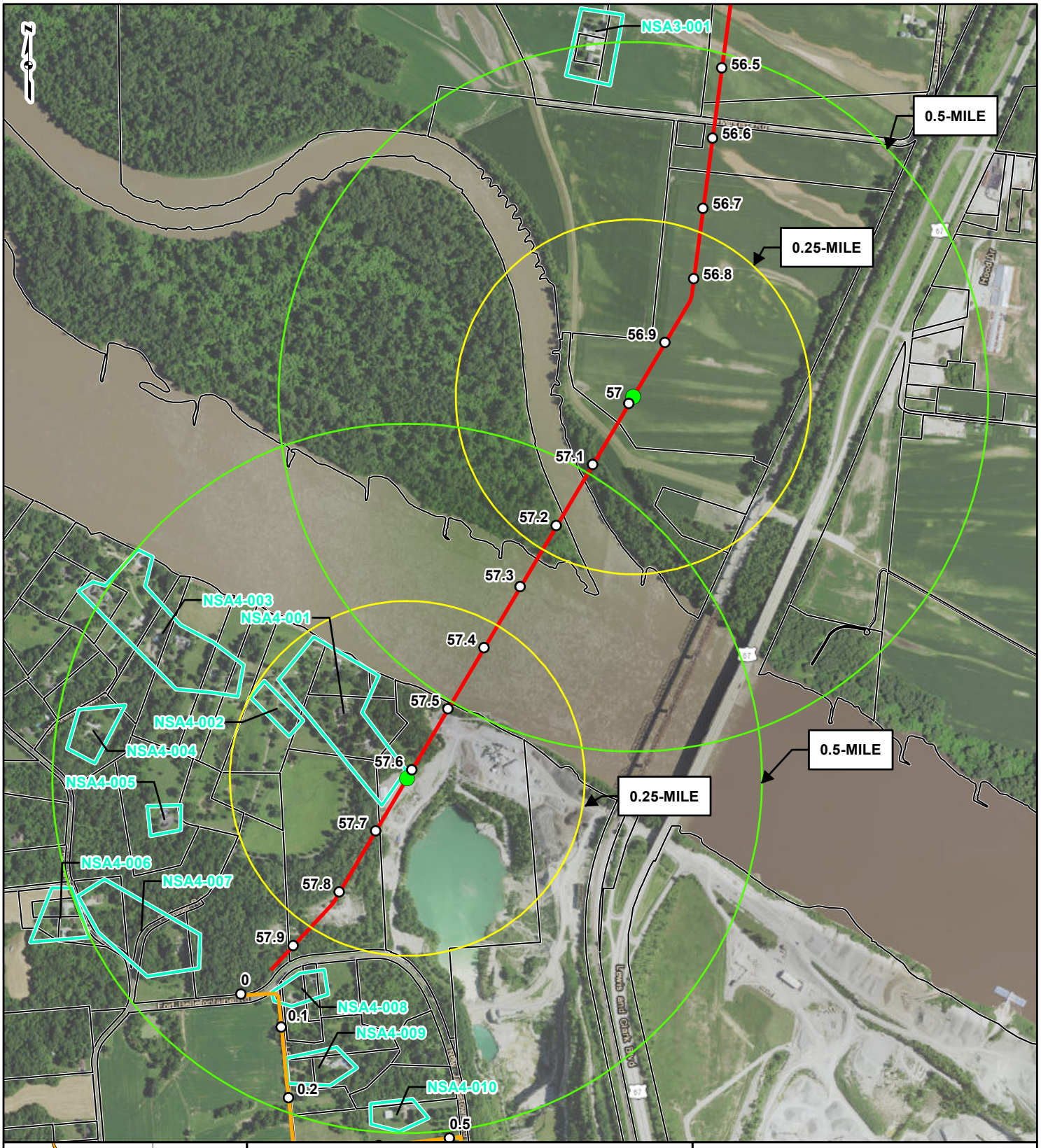
Figure 9.2-2. Delineated Noise Sensitive Areas - Missouri River



NOISE SENSITIVE AREAS

SPIRE STL PIPELINE PROJECT

gai consultants

spire

DRAWN BY: PMH DATE: 10/14/2016

CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 10/2016.

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9.2.4 Noise Mitigation

For diesel equipment used during construction of the Project, if it is found to be necessary to mitigate noise, it is anticipated that common construction mitigation measures such as vibration control, mufflers, etc. would be utilized for the Project. However, for this Project, it is not anticipated that mitigation for diesel equipment will be necessary at this time due to the temporary duration of construction along the Project corridor and the restriction of hours of construction on the Project.

HDD noise impacts determined in Section 9.2.3, Noise Impacts, may be mitigated as determined necessary through measures such as:

- installing noise barriers;
- enclosing the drill rig fully or partially; and
- offering to temporarily relocate affected NSAs during short periods of elevated noise.

Noise mitigation for M&R facilities will be evaluated once baseline noise surveys are completed.

Appendix 9-B will provide detailed analysis of methodology, source sound level data, and proposed noise control treatments for each noise study.

9.3 References

Intergovernmental Panel on Climate Change. 2006. *IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 3 Mobile Combustion*. Accessed September 2016 from http://www.ipcc-nggip.iges.or.jp/public/2006gl/

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APPENDIX 9-A

Emission Estimates

Table 9A-1

Potential Emissions from Off-Road Engines (24-inch Pipeline)

Equipment Type	HP	Estimated Operating Hours: 24-inch Pipeline: Number	Months at Project	% Utilization	Total Hours[2]	Emission Factors (g/hp-hr)[1]: HC[3]	CO	SO_2[4]	NO_x	Particulates[5]	Estimated Emissions (tons/yr): VOC	CO	SO_2	NO_x	$PM1_0$	$PM_{2.5}$
Cranes																
Crane: 150 ton	425	4	0.11	50%	88	0.68	2.7	4.86E-03	8.38	0.402	0.03	0.11	2.00E-04	0.35	0.02	0.02
Earthwork/Concrete Equipment																
Excavator	155	12	6.4	50%	15,360	0.68	2.7	4.86E-03	8.38	0.402	1.78	7.09	1.28E-02	22.00	1.06	1.02
Excavator	213	8	6.4	50%	10,240	0.68	2.7	4.86E-03	8.38	0.402	1.64	6.49	1.17E-02	20.15	0.97	0.94
Excavator	271	4	6.4	50%	5,120	0.68	2.7	4.86E-03	8.38	0.402	1.04	4.13	7.44E-03	12.82	0.61	0.60
Side Boom	121	8	4.6	50%	7,314	0.68	2.7	4.86E-03	8.38	0.402	0.66	2.63	4.74E-03	8.18	0.39	0.38
Dozer	170	4	6.4	50%	5,120	0.68	2.7	4.86E-03	8.38	0.402	0.65	2.59	4.67E-03	8.04	0.39	0.37
Dozer	190	4	6.4	50%	5,120	0.68	2.7	4.86E-03	8.38	0.402	0.73	2.90	5.21E-03	8.99	0.43	0.42
Vehicles																
Tracked Dumper	120	8	5.3	50%	8,533	0.68	2.7	4.86E-03	8.38	0.402	0.77	3.05	5.49E-03	9.46	0.45	0.44
Road Tractor	425	4	4.5	50%	3,608	0.68	2.7	4.86E-03	8.38	0.402	1.15	4.57	8.22E-03	14.17	0.68	0.66
Straight Truck	250	4	5.4	50%	4,328	0.68	2.7	4.86E-03	8.38	0.402	0.81	3.22	5.80E-03	10.00	0.48	0.47
UTV	50	16	5.4	50%	17,310	1.8	5	9.36E-03	6.9	0.8	1.72	4.77	8.94E-03	6.58	0.76	0.74
Air Compressors																
Air Compressor	50	8	4.5	50%	7217	1.8	5	9.36E-03	6.9	0.8	0.72	1.99	3.73E-03	2.74	0.32	0.31
Miscellaneous Equipment																
Bending Machine	45	4	4.0	50%	3206	1.8	5	9.36E-03	6.9	0.8	0.29	0.80	1.49E-03	1.10	0.13	0.12
Boring Machine	140	1	6.4	80%	2048	1.8	5	4.86E-03	6.9	0.8	0.57	1.58	1.54E-03	2.18	0.25	0.25
Total Estimated Emissions (Tons/Project/Year)											**VOC**	**CO**	**SO_2**	**NOx**	**PM_{10}**	**$PM_{2.5}$**
											12.55	**45.91**	**0.08**	**126.75**	**6.94**	**6.73**

Notes:

VMT per Day for 24-inch Pipeline: [5]

[2] Assume 100 hour work weeks and four weeks per month.

[3] Assume Hydrocarbon(HC) approximately equal to VOCs.

[4] Assumes Ultra Low Sulfur Diesel Fuel of 15ppm sulfur.

[5] Per the *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition,* all PM emissions are assumed to be smaller than 10 microns (PM_{10}) and 97% of the PM is assumed to be smaller than

Table 9A-2

Potential Emissions from Off-Road Engines (Line 880)

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr)[1]					Estimated Emissions (tons/yr)					
		Line 880														
		Number	Months at Project	% Utilization	Total Hours[2]	HC[3]	CO	SO_2[4]	NO_x	Particulates[5]	VOC	CO	SO_2	NO_x	$PM1_0$	$PM_{2.5}$
Cranes																
Crane: 150 ton	425	1	0.07	50%	8	0.68	2.7	4.86E-03	8.38	0.402	0.00	0.01	1.91E-05	0.03	0.00	0.00
Earthwork/Concrete Equipment																
Excavator	155	3	4.2	50%	1,512	0.68	2.7	4.86E-03	8.38	0.402	0.18	0.70	1.26E-03	2.17	0.10	0.10
Excavator	213	2	4.2	50%	1,008	0.68	2.7	4.86E-03	8.38	0.402	0.16	0.64	1.15E-03	1.98	0.10	0.09
Excavator	271	1	4.2	50%	504	0.68	2.7	4.86E-03	8.38	0.402	0.10	0.41	7.32E-04	1.26	0.06	0.06
Side Boom	121	2	3	50%	720	0.68	2.7	4.86E-03	8.38	0.402	0.07	0.26	4.67E-04	0.80	0.04	0.04
Dozer	170	1	4.2	50%	504	0.68	2.7	4.86E-03	8.38	0.402	0.06	0.26	4.59E-04	0.79	0.04	0.04
Dozer	190	1	4.2	50%	504	0.68	2.7	4.86E-03	8.38	0.402	0.07	0.29	5.13E-04	0.88	0.04	0.04
Vehicles																
Tracked Dumper	120	2	3.5	50%	840	0.68	2.7	4.86E-03	8.38	0.402	0.08	0.30	5.40E-04	0.93	0.04	0.04
Road Tractor	425	1	2.96	50%	355	0.68	2.7	4.86E-03	8.38	0.402	0.11	0.45	8.09E-04	1.39	0.07	0.06
Straight Truck	250	1	3.55	50%	426	0.68	2.7	4.86E-03	8.38	0.402	0.08	0.32	5.71E-04	0.98	0.05	0.05
UTV	50	4	3.55	50%	1,704	1.8	5	9.36E-03	6.9	0.8	0.17	0.47	8.80E-04	0.65	0.08	0.07
Air Compressors																
Air Compressor	50	2	2.96	50%	710	1.8	5	9.36E-03	6.9	0.8	0.07	0.20	3.67E-04	0.27	0.03	0.03
Miscellaneous Equipment																
Bending Machine	45	1	2.63	50%	316	1.8	5	9.36E-03	6.9	0.8	0.03	0.08	1.47E-04	0.11	0.01	0.01
Boring Machine	140	1	4.2	80%	806	1.8	5	4.86E-03	6.9	0.8	0.22	0.62	6.05E-04	0.86	0.10	0.10
Total Estimated Emissions (Tons/Project/Year)											**VOC**	**CO**	**SO_2**	**NOx**	**PM_{10}**	**$PM_{2.5}$**
											1.40	**4.99**	**0.01**	**13.12**	**0.76**	**0.73**

Notes:

VMT per Day for 24-inch Pipeline: [5]

[2] Assume 60 hour work weeks and four weeks per month.

[3] Assume Hydrocarbon(HC) approximately equal to VOCs.

[4] Assumes Ultra Low Sulfur Diesel Fuel of 15ppm sulfur.

[5] Per the *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition,* all PM emissions are assumed to be smaller than 10 microns (PM_{10}) and 97% of the PM is assumed to be smaller than

Table 9A-3

Potential Fugitive Emissions from Unpaved Roads (24-inch Pipeline)

Equipment Type	HP	Estimated Operating Hours: 24-inch Pipeline: Number	Months at Project	% Utilization	Total Hours	Additional Information: W: mean vehicle Wt (tons)[2]	S: surface material Silt Content (%)[3]	Emission Factors[1]: E: based on PM_{10} (lb/VMT)	E: based on $PM_{2.5}$ (lb/VMT)	Estimated Emissions: VMT: Vehicle Miles Traveled (mi per project)	Fugitive Particulate PM_{10} (tons per project)	Fugitive Particulate $PM_{2.5}$ (tons per project)
Cranes												
Crane: 150 ton	425	4	0.1	50%	88	150	8.5%	6.40	0.64	24	0.08	0.01
Earthwork/Concrete Equipment												
Excavator	155	12	6.4	50%	15,360	24	8.5%	2.80	0.28	1378	1.93	0.19
Excavator	213	8	6.4	50%	10,240	35	8.5%	3.32	0.33	1378	2.29	0.23
Excavator	271	4	6.4	50%	5,120	40	8.5%	3.53	0.35	1378	2.43	0.24
Side Boom	121	8	4.6	50%	7,314	16	8.5%	2.34	0.23	984	1.15	0.11
Dozer	170	4	6.4	50%	5,120	21	8.5%	2.64	0.26	1378	1.82	0.18
Dozer	190	4	6.4	50%	5,120	23	8.5%	2.75	0.28	1378	1.89	0.19
Vehicles												
Tracked Dumper	120	8	5.3	50%	8,533	7	8.5%	1.61	0.16	1148	0.92	0.09
Road Tractor	425	4	4.5	50%	3,608	18.0	8.5%	2.46	0.25	971	1.20	0.12
Straight Truck	250	4	5.4	50%	4,328	18.0	8.5%	2.46	0.25	1164	1.43	0.14
UTV	50	16	5.4	50%	17,310	0.83	8.5%	0.62	0.06	1164	0.36	0.04
Air Compressors												
Air Compressor	50	8	4.5	50%	7,217	1.1	8.5%	0.69	0.07	971	0.33	0.03
Miscellaneous Equipment												
Bending Machine	45	4	4.0	50%	3,206	15	8.5%	2.27	0.23	863	0.98	0.10
Boring Machine[4]	140	1	6.4	80%	2,048	NA	-	-	-	-	-	-
Total Estimated Emissions (Tons/Project/Year) - Uncontrolled											**16.81**	**1.68**
Total Estimated Emissions (Tons/Project/Year) - Controlled											**10.09**	**1.01**

Estimated Travel Distances:		
VMT per Day for 24-inch Pipeline:[5]	7.175	mi.
Water Spray Control Efficiency[6]	0.4	%

Notes:

[1] Calculations based EPA's AP 42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources Chapter 13.0 – Introduction to Miscellaneous Sources, Section 13.2 – Introduction to Fugitive Dust Sources Final Section of 13.2.2 Unpaved Roads (November 2006) 13.2.2. Unpaved Roads

[2] Mean Vehicle Weight for equipment engines obtained from Dataquest, 2006 and public sources (Caterpillar home page and Internet).

[3] Surface Material Silt Content estimated based on similar projects and data from AP-42, Chapter 13.2.2 Table 13.2-1 Construction Sites.

[4] Boring Machine is moved into place and does not move on a daily basis; therefore, emissions are not calculated for this piece of equipment.

[5] Assumed that each piece of equipment travels a length of 25% of the right-of-way spread on a daily basis.

[6] Based on low end of test data range of 40% to 70% for PM-10 from, obtained from background Document Emission Factor Documentation for AP-42, Section 13.2.2 Unpaved Roads Final Report (September 1998).

Table 9A-4
Potential Fugitive Emissions from Unpaved Roads (Line 880)

Equipment Type	HP	Estimated Operating Hours				Additional Information		Emission Factors[1]		Estimated Emissions		
		Line 880										
		Number	Months at Project	% Utilization	Total Hours	W: mean vehicle Wt (tons)[2]	S: surface material Silt Content (%)[3]	E: based on PM_{10} (lb/VMT)	E: based on $PM_{2.5}$ (lb/VMT)	VMT: Vehicle Miles Traveled (mi per	Fugitive Particulate PM_{10} (tons per project)	Fugitive Particulate $PM_{2.5}$ (tons per project)
Cranes												
Crane: 150 ton	425	1	0.1	50%	8	150	8.5%	6.40	0.64	4	0.01	0.00
Earthwork/Concrete Equipment												
Excavator	155	3	4.2	50%	1,512	24	8.5%	2.80	0.28	239	0.34	0.03
Excavator	213	2	4.2	50%	1,008	35	8.5%	3.32	0.33	239	0.40	0.04
Excavator	271	1	4.2	50%	504	40	8.5%	3.53	0.35	239	0.42	0.04
Side Boom	121	2	3.0	50%	720	16	8.5%	2.34	0.23	171	0.20	0.02
Dozer	170	1	4.2	50%	504	21	8.5%	2.64	0.26	239	0.32	0.03
Dozer	190	1	4.2	50%	504	23	8.5%	2.75	0.28	239	0.33	0.03
Vehicles												
Tracked Dumper	120	2	3.5	50%	840	7	8.5%	1.61	0.16	200	0.16	0.02
Road Tractor	425	1	3.0	50%	355	18.0	8.5%	2.46	0.25	169	0.21	0.02
Straight Truck	250	1	3.6	50%	426	18.0	8.5%	2.46	0.25	202	0.25	0.02
UTV	50	4	3.6	50%	1,704	0.83	8.5%	0.62	0.06	202	0.06	0.01
Air Compressors												
Air Compressor	50	2	3.0	50%	710	1.1	8.5%	0.69	0.07	169	0.06	0.01
Miscellaneous Equipment												
Bending Machine	45	1	2.6	50%	316	15	8.5%	2.27	0.23	150	0.17	0.02
Boring Machine [4]	140	1	4.2	80%	806	NA	-	-	-	-	-	-
Total Estimated Emissions (Tons/Project/Year) - Uncontrolled											**2.92**	**0.29**
Total Estimated Emissions (Tons/Project/Year) - Controlled											**1.75**	**0.18**
Estimated Travel Distances:												
VMT per Day for 24-inch Pipeline: [5]	1.9	mi.										
Water Spray Control Efficiency [6]	0.4	%										

Notes:

[1] Calculations based on equation (1a) [Emission Factor (lb/VMT): E = k*[(s/12)^a]*(W/3)^b] from EPA's AP 42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources Chapter 13.0 – Introduction to Miscellaneous Sources, Section 13.2 – Introduction to Fugitive Dust Sources Final Section of 13.2.2 Unpaved Roads (November 2006)

[2] Mean Vehicle Weight for equipment engines obtained from Dataquest, 2006 and public sources (Caterpillar home page and Internet).

[3] Surface Material Silt Content estimated based on similar projects and data from AP-42, Chapter 13.2.2 Table 13.2-1 Construction Sites.

[4] Boring Machine is moved into place and does not move on a daily basis; therefore, emissions are not calculated for this piece of equipment.

[5] Assumed that each piece of equipment travels a length of 25% of the right-of-way spread on a daily basis.

[6] Based on low end of test data range of 40% to 70% for PM-10 from, obtained from background Document Emission Factor Documentation for AP-42, Section 13.2.2 Unpaved Roads Final

Table 9A-5
Material Handling Emission Calculation Basis Data (24-inch Pipeline and Line 880)

Project Aspect	Parameter	units	24-inch Pipeline	Line 880
All Aspects	Pipe Length	miles	57.4	7.6
	Dig Sites [1]	#	-	53
	Pipe Length	yards	101,024	13,376
	Pipe Length	feet	303,072	40,128
	Length in Agricultural Use [2]	miles	52	3
	Length in Agricultural Use	Yards	90,922	5,350
	Length in Agricultural Use	Feet	272,765	16,051
Trench Spoil Pile	Pipe Diameter	inches	24.0	20.0
	Max Trench Bottom Width [3]	feet	4.0	3.7
	Max Trench Top Width	feet	15	-
	Max Dig Site Width [4]	feet	-	25
	Max Dig Site Width [4]	yards	-	8.33
	Max Trench Width @ Top Soil Spoil Interface	feet	12.938	21.001
	Total - Max Trench Depth Removed	feet	8	8
	Total - Trench Cross Sectional Area [5]	ft^2	76.00	114.68
	Total - Trench Cross Sectional Area [5]	yd^2	8.44	12.74
	Total - Volume of Soil Material Moved	yd^3	852,643	5,625
	Spoil - Max Depth of Removed	feet	6.5	6.5
	Spoil - Cross Sectional Area	ft^2	55.05	80.18
	Spoil - Cross Sectional Area	yd^2	6.12	8.91
	Spoil - Volume of Material Moved	yd^3	618,267	3,934
	Spoil - Pile height	feet	5.2	6.3
	Spoil - Pile base (width)	feet	10.5	12.7
	Spoil - Pile Face	feet	7.4	9.0
	Spoil - Pile Surface Area [6]	ft^2	2,248,664	3,953
	Spoil - Pile Surface Area [6]	yd^2	249,852	439
Trench Top Soil Pile	Top Soil - Max Depth of Topsoil Removed [7]	feet	1.5	1.5
	Top Soil - Cross Sectional Area from Trench [5]	ft^2	20.95	34.5
	Top Soil - Cross Sectional Area from Trench [5]	yd^2	2.33	3.83
	Top Soil - Width of Top Soil Removed In Workspace [8]	feet	31.49	40.0
	Top Soil - Cross Sectional Area	ft^2	45.69	34.50
	Top Soil - Cross Sectional Area	yd^2	5.08	3.83
	Top Soil - Volume of Material Moved	yd^3	512,896	3,662
	Top Soil - Pile height	feet	4.6	5.9
	Top Soil - Pile base (width)	feet	9.2	11.7
	Top Soil - Pile Face	feet	6.5	8.3
	Top Soil - Pile Surface Area [6]	ft^2	653,930	111,109
	Top Soil - Pile Surface Area [6]	yd^2	72,659	12,345
Agricultural Top Soil Removed	Top Soil - Max Depth of Topsoil Removed [7]	feet	1.5	1.5
	Top Soil - Width of Extra Topsoil removed in Ag areas [9]	feet	50	15
	Top Soil - Additional Cross Sectional Area for Ag lands	ft^2	75	22.5
	Top Soil - Additional Cross Sectional Area for Ag lands	yd^2	8.33	2.50
	Top Soil - Additional Volume of Material Moved in Ag Lands	yd^3	757,680	441
	Top Soil - Pile height for Additional Ag Soil Pile	feet	8.7	4.7
	Top Soil - Pile base (width) for Additional Ag Soil Pile	feet	17.3	9.5
	Top Soil - Pile Face for Additional Ag Soil Pile	feet	12.2	6.7
	Top Soil - Pile Surface Area for Additional Ag Soil Pile [6]	ft^2	3,340,673	107,675
	Top Soil - Pile Surface Area for Additional Ag Soil Pile [6]	yd^2	371,186	11,964

Notes:

[1] For Line 880, it was assumed there where 7 dig sites per mile

[2] Assumed 90% of land in Illlinois and 40% in Missouri was in agricultural use.

[3] Assumed one foot of space between walls and each side of pipe.

[4] Assumed a 25ft by 25ft dimension at each dig site.

[5] Trench is a shape of a trapezoid.

[6] Assume pile is a triangular mound, with 45 degree slopes, that runs the length of open trench, that base of pile equals Max Trench Top Width, and that shape of the end of pile is ignored.

[7] Used 1.5 feet as topsoil depth due to deeper topsoil layers anticipated in IL.

[8] Equal to width of trench plus width of base of spoil pile and 6 foot buffer.

[9] Assumed top soil removed in the agricultural areas is equal to two 25 foot travel lanes for 24-inch pipeline and one 15 foot travel lane for Line 880.

Table 9A-6
Material Handling & Wind Erosion Emission Calculation Basis Data
(24-inch Pipeline and Line 880)

Site and Material Specific Information			
		Value	
Parameters	**Units**	**24-inch Pipeline**	**Line 880**
Mean Wind Speed (U) [1]	mph	9.1	
Volume of Spoil Material Moved [2]	yd^3	1,236,534	7,867
Volume of Top Soil Material Moved [2]	yd^3	2,541,153	8,207
Density of Soil [3]	lb/yd^3	2,241.79	
Mass of Spoil Material Moved	tons	1,386,025	8,818
Mass of Top Soil Material Moved	tons	2,848,365	9,199
Working Surface Area of Spoil Piles [4]	yd^2	13,058	110
Working Surface Area of Top Soil Piles [4]	yd^2	23,197	6,077
Length of open trench/dig site [5]	miles	3	0.06
Material Moisture Content - Spoil (M) [6]	%	7.4	
Material Moisture Content - Top Soil (M) [7]	%	12.0	

Site and Material Specific Information							
		24-inch Pipeline			Line 880		
Parameters	**Units**	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Handling Particulate Size Multiplier (k) [8]	--	0.74	0.35	0.053	0.74	0.35	0.053
Handling Emission Factor Spoil Material [9]	lb/ton	8.26E-04	3.91E-04	5.92E-05	8.26E-04	3.91E-04	5.92E-05
Handling Emission Factor Top Soil Material [9]	lb/ton	4.20E-04	1.99E-04	3.01E-05	4.20E-04	1.99E-04	3.01E-05
Wind Erosion Emission Factor [10]	lb/yd^2	5.04E-02	2.52E-02	1.01E-02	5.04E-02	2.52E-02	1.01E-02
Handling Spoil Emissions	tons	0.57	0.27	0.04	0.004	0.002	0.0003
Handling Top Soil Emissions	tons	0.60	0.28	0.04	0.002	0.001	0.0001
Wind Erosion Spoil Pile Emissions	tons	0.33	0.16	0.07	0.003	0.001	0.001
Wind Erosion Top Soil Pile Emissions	tons	0.58	0.29	0.12	0.15	0.08	0.03
Total Emissions	**tons**	**2.08**	**1.01**	**0.27**	**0.16**	**0.08**	**0.03**

Notes:

[1] St. Louis, Missouri (KSTL) Local Climatological Data, Normals, Means, and Extremes.

[2] Volume doubled because material is removed and replaced.

[3] Density from USDA, NRCS, *Soil Quality Indicators* , Medium textured soil 50% pore space.

[4] Working Surface Area is the surface area of pile(s) adjacent to the open trench.

[5] Assumed 3 miles of open trench on the 24-inch pipeline and 25% of the dig sites on Line 880.

[6] Based on mean value listed in AP-42 Table 13.2.4-1, Municipal solid waste landfills, Sand.

[7] Based on mean value listed in AP-42 Table 13.2.4-1, Municipal solid waste landfills, Cover.

[8] Particle size multiplier obtained from values listed in AP-42 page 13.2.4-4.

[9] Emission factor calculated using equation (1) in AP-42 Chapter 13.2.4, Emission Factor (lb/ton): E = k*0.0032*[(U/5)^1.3]/[(M/2)^1.4]

[10] Emission factor calculated using questions in AP-42 Chapter 13.2.5 as detailed in Table 9A-6a.

Table 9A-6a
Wind Erosion Emission Factor Calculation Basis Data (24-inch Pipeline and Line 880)

Basis for Calculations:

AP-42 Chapter 13.2.5 Industrial Wind Erosion

EF = emission factor, g/m^2 (EF_c is for chronic conditions, EF_a is for acute conditions)
k = particle size multiplier, dimesionless
N = number of days of disturbances per year
P_i = erosion potential for disturbed area, g/m^2 (Per AP-42, erosion potential is assumed to be 0 between disturbances and for undisturbed areas.)
u* = fiction velocity, m/s
u_t* = threshold friction velocity m/s (From Table 13.2.5-2, ut* ranges from 0.54 m/s for fine coal dust to 1.33 m/s for roadbed material; From Table 13.2.5-2, ut* = 1.02 m/s for overburden at a coal mine)

u_{10}^+ = fastest mile of wind, m/s, at reference anemometer height of 10 m.
A = disturbed area, m^2
E = emissions, grams/year

Equation (1): $u^* = 0.053 * u_{10}^+$

Equation (2): $P_i = 58*(u^* - u_t^*)^2 + 25*(u^* - u_t^*)$

Equation (3): $EF = k * S P_i$

Equation (4): $E = EF * A$

Meteorological Information:

VMT per Day for 24-inch Pipeline: [5]

Station: [1] **St. Louis, MO (KSTL) WBAN13994**

Parameter	Value	Units
Anemometer Height (z) [2]	10	meters
MAX 2-minute Wind Speed:	53	mph
MAX 2-minute Wind Speed:	23.69	m/s
Roughness Height: [3]	0.005	meters

Emission Factor Calculation:

Variable	Both 24-inch Pipeline & Line 880	
u_{10}^+	23.69	For St. Louis, MO (KSTL) WBAN13994 u+ = 53 mph (23.69 m/s) at 10 m)
u*	1.256	Calculated using equation (1).
u_t*	1.02	Overbuden from Table 13.2.5-2 was used
P_i	9.11	Calculated using Equation (2). Note: If u* < u_t*, then P_i = 0.
N	3	Assume stockpile are disturbed 3 times during construction

PM =>	< 30 mm	< 15 mm	< 10 mm	< 2.5 mm
k [4]	1.0	0.6	0.5	0.2
EF (g/m^2) [5]	27.32	16.39	13.66	5.46
EF (lb/yd^2)	5.04E-02	3.02E-02	2.52E-02	1.01E-02

Notes:
[1] National Oceanic and Atmospheric Administration, National Centers for Environmental Information. 2015. Local Climatological Data Annual Summary with Comparative Data – ST Louis Missouri (KSTL).
[2] KSTL's Anemometer has been 10 meters since 1996, per the "anenometer_height__info" excel file found at the link below.
[3] A typical roughness height of 0.5 cm (0.005 m) has been assumed. If a site a specific roughness height is available, it should be used.
[4] Particle size multiplier obtained from values listed in AP-42 page 13.2.5-3.
[5] Calculated using Equation (3) and daily condition variables.

http://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/

Table 9A-7
Potential Greenhouse Gas Emissions (24-inch Pipeline)

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr) [1]			Estimated Emissions (tons/yr)		
		24-inch Pipeline									
		Number	Months at Project	% Utilization	Total Hours [2]	CO_2	N_2O	CH_4	CO_2	N_2O	CH_4
Cranes											
Crane: 150 ton	425	4	0.1	50%	88	199.1	0.0111	0.0768	8.21	0.00046	0.00317
Earthwork/Concrete Equipment											
Excavator	155	12	6.4	50%	15,360	199.1	0.0111	0.0768	522.57	0.02927	0.20169
Excavator	213	8	6.4	50%	10,240	199.1	0.0111	0.0768	478.74	0.02681	0.18478
Excavator	271	4	6.4	50%	5,120	199.1	0.0111	0.0768	304.55	0.01706	0.11755
Side Boom	121	8	4.6	50%	7,314	199.1	0.0111	0.0768	194.26	0.01088	0.07498
Dozer	170	4	6.4	50%	5,120	199.1	0.0111	0.0768	191.05	0.01070	0.07374
Dozer	190	4	6.4	50%	5,120	199.1	0.0111	0.0768	213.52	0.01196	0.08241
Vehicles											
Tracked Dumper	120	8	5.3	50%	8,533	199.1	0.0111	0.0768	224.76	0.01259	0.08675
Road Tractor	425	4	4.5	50%	3,608	199.1	0.0111	0.0768	336.61	0.01885	0.12992
Straight Truck	250	4	5.4	50%	4,328	199.1	0.0111	0.0768	237.47	0.01330	0.09166
UTV	50	16	5.4	50%	17,310	199.1	0.0111	0.0768	189.98	0.01064	0.07332
Air Compressors											
Air Compressor	50	8	4.5	50%	7,217	199.1	0.0111	0.0768	79.20	0.00444	0.03057
Miscellaneous Equipment											
Bending Machine	45	4	4.0	50%	3,206	199.1	0.0111	0.0768	31.67	0.00177	0.01222
Boring Machine	140	1	6.4	80%	2,048	199.1	0.0111	0.0768	62.93	0.00352	0.02429
Total Estimated Emissions (Tons/Project/Year)									**CO2**	**N2O**	**CH4**
									3,075.5	**0.17**	**1.19**

Notes:

VMT per Day for 24-inch Pipeline: [5]

Original Default Factors given in Kg/TJ for Diesel Off-Road Mobile Sources: 74,100 4.15 28.6 (in Kg/TJ)

[2] Assume 100 hour work weeks and four weeks per month.

Table 9A-8
Potential Greenhouse Gas Emissions (Line 880)

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr) [1]			Estimated Emissions (tons/yr)		
		Line 880									
		Number	Months at Project	% Utilization	Total Hours [2]	CO_2	N_2O	CH_4	CO_2	N_2O	CH_4
Cranes											
Crane: 150 ton	425	1	0.1	50%	8	199.1	0.0111	0.0768	0.78	0.00004	0.00030
Earthwork/Concrete Equipment											
Excavator	155	3	4.2	50%	1,512	199.1	0.0111	0.0768	51.44	0.00288	0.01985
Excavator	213	2	4.2	50%	1,008	199.1	0.0111	0.0768	47.13	0.00264	0.01819
Excavator	271	1	4.2	50%	504	199.1	0.0111	0.0768	29.98	0.00168	0.01157
Side Boom	121	2	3.0	50%	720	199.1	0.0111	0.0768	19.12	0.00107	0.00738
Dozer	170	1	4.2	50%	504	199.1	0.0111	0.0768	18.81	0.00105	0.00726
Dozer	190	1	4.2	50%	504	199.1	0.0111	0.0768	21.02	0.00118	0.00811
Vehicles											
Tracked Dumper	120	2	3.5	50%	840	199.1	0.0111	0.0768	22.12	0.00124	0.00854
Road Tractor	425	1	3.0	50%	355	199.1	0.0111	0.0768	33.13	0.00186	0.01279
Straight Truck	250	1	3.6	50%	426	199.1	0.0111	0.0768	23.38	0.00131	0.00902
UTV	50	4	3.6	50%	1,704	199.1	0.0111	0.0768	18.70	0.00105	0.00722
Air Compressors											
Air Compressor	50	2	3.0	50%	710	199.1	0.0111	0.0768	7.80	0.00044	0.00301
Miscellaneous Equipment											
Bending Machine	45	1	2.6	50%	316	199.1	0.0111	0.0768	3.12	0.00017	0.00120
Boring Machine	140	1	4.2	80%	806	199.1	0.0111	0.0768	24.78	0.00139	0.00956
Total Estimated Emissions (Tons/Project/Year)									**CO2**	**N2O**	**CH4**
									321.3	**0.02**	**0.12**

Notes:

VMT per Day for Line 880: [5]

Original Default Factors given in Kg/TJ for Diesel Off-Road Mobile Sources: 74,100 4.15 28.6 (in Kg/TJ)

[2] Assume 60 hour work weeks and four weeks per month.

APPENDIX 9-B

Pre-Construction Noise Survey Analysis Report (to be provided in the FERC Application)

APPENDIX 9-C

Fugitive Dust Control Plan

Spire STL Pipeline Project

Fugitive Dust Control Plan

FERC Docket No.PF16-9-000

Draft
October 2016

Public

Table of Contents

Acronyms and Abbreviations

Project	Spire STL Pipeline Project
Spire	Spire STL Pipeline LLC

Fugitive Dust Control Plan

1.1 Introduction

Land disturbance from construction activities has the potential to generate fugitive dust emissions. Dust control measures may reduce surface and air movement of dust from disturbed soil surfaces. This Fugitive Dust Control Plan describes the general control measures to be implemented by Spire STL Pipeline LLC ("Spire") and its contractors to ensure that dust suppression techniques are taken during construction of the Spire STL Pipeline Project ("Project"). Measures identified within this Fugitive Dust Control Plan outline dust control methods that will be used on all work areas including temporary workspaces and access roads and outlines the recommended records to be maintained onsite during construction.

1.2 Fugitive Dust Emission Sources

The following Project activities have the potential to generate fugitive dust:

- vegetation removal;
- clearing and grading;
- topsoil removal;
- cutting and filling;
- trenching;
- backfilling;
- track-out onto roads;
- bulk material loading, hauling, and unloading;
- vehicle and motorized equipment movement on unpaved access roads;
- use of material storage piles; and
- use of parking, staging, and storage areas.

It is the responsibility of the Project contractor(s) and the designated Environmental Inspector(s) to ensure that:

- sources of potential dust generation are identified;
- specific areas of Project construction will be monitored for fugitive dust generation; and
- appropriate dust suppression techniques are implemented when dust plumes are visible.

1.3 Fugitive Dust Control Methods

1.3.1 Pipeline Construction Activities and Other Earth Disturbances

Fugitive dust emissions from vegetation removal, clearing and grading, cutting and filling, topsoil removal, trenching, backfilling, and stockpile storage will be controlled to the extent possible by applying water if sustained visible dust plumes occur. Water would be acquired from municipal sources should this be necessary. Additionally, spoil piles left undisturbed can be temporarily stabilized to prevent wind and water erosion if fugitive dust becomes an issue along the construction right-of-way.

1.3.2 Unpaved Roads

Fugitive dust emissions generated by motorized equipment and miscellaneous vehicle traffic will be controlled by wet suppression as necessary. Fugitive dust emissions from active access roads will be controlled by periodic wetting of surfaces using a water truck. During periods of high truck traffic, road surfaces will be wetted more frequently to minimize fugitive emissions. Watering will occur less frequently if meteorological conditions (e.g., rain, frozen surfaces, etc.) are adequate to suppress dust. Additionally, construction traffic will reduce speeds on unpaved roads as necessary.

1.3.3 Paved Roads

Fugitive dust emissions from paved roads will be controlled with a combination of wet suppression, sweeping and/or vacuuming, as appropriate, to minimize the amount of fugitive dust that is generated.

1.3.4 Track-out onto Roads

Track-out of loose materials will be controlled by maintaining construction entrances on access roads that begin at junctions with paved roads. This is done to prevent tracking of mud on to public roadways. Soil tracked onto a paved road will be cleaned up by the Contractor by the end of each working day.

1.3.5 Deposition on Other Premises

Spire will take all appropriate actions to prevent the deposition of solid or liquid materials onto any other premises from the Project site and access roads which may cause or contribute to visible dust emissions. Preventive actions may include, but are not limited to dust control, such as wet suppression, the operation of a sweeper truck on paved roadways equipped with water suppression, and the operation of a vacuum truck.

1.4 Tackifers

The construction contractor may propose the use of tackifiers to reduce fugitive dust provided that the product to be utilized has been approved by the appropriate State and Municipal entities where its application will occur. The construction contractor will detail the proposed use of any such substances and provide copies of the Material Safety Data Sheet and application procedures.

1.5 Inspection, Monitoring, and Record Keeping

The construction contractor will implement the dust control measures specified in this Fugitive Dust Control Plan, and construction personnel will be informed of the measures in this Plan. Environmental Inspectors will have primary responsibility for monitoring and enforcing the implementation of dust control measures by the construction contractor. Environmental Inspectors will also be responsible for ensuring that these measures are effective and proper documentation is maintained. When environmental conditions are dry, inspection of dust control measures will be conducted daily, and the Environmental Inspectors will be responsible for recording the following information on a daily basis:

- weather conditions, including temperature, wind speed, and wind direction;
- number of water trucks in use;
- incidents where dust concentration is such that special abatement measures must be implemented;
- condition of soils (damp, crusted, unstable, other) on the right-of-way and other construction sites;
- condition of soils (damp, crusted, unstable, other) on access roads;
- condition of track-out pads; and
- overall status of dust control compliance.

This information will be incorporated into the Environmental Inspector's daily report, and significant instances of non-compliance with the Fugitive Dust Control Plan will be reported to the Construction Manager as soon as they are discovered.

1.6 Plan Maintenance

A copy of this Fugitive Dust Control Plan will be retained on-site, and it will be made available to the federal, state, and local agencies upon request.

1.7 Staff Training

All staff that are responsible for implementing this Fugitive Dust Control Plan. Project contractors will be trained on this Fugitive Dust Control Plan prior to the commencing of construction as part of Spire's Environmental Training Program.