Resource Report 9
Air and Noise Quality

Resource Report No. 9 Air and Noise Quality

Central Mainline Corridor Expansion Project

FERC Docket No. CP26- -000

April 2026

RESOURCE REPORT 9 – AIR AND NOISE QUALITY SUMMARY OF FILING INFORMATION

MINIMUM REQUIREMENTS	LOCATION ADDRESSED
Describe existing air quality in the vicinity of the projects – Title 18 Code of Federal Regulations (CFR) § 380.12(k)(1)	Section 9.1.1
Quantify the existing noise levels (day-night sound level (L_{dn}) and other applicable noise parameters) at noise sensitive areas and at other areas covered by relevant state and local noise ordinances – 18 CFR § 380.12(k)(2)	Sections 9.2.1 and 9.2.2; Tables 9.2-1 and 9.2-2
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 – 18 CFR § 380.12(k)(3)	Sections 9.1.2, Tables 9.1-3. and Appendix 9A
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 – 18 CFR § 380.12(k)(4)	N/A
Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure – 18 CFR § 380.12(k)(4) Compression is not part of the project; Northern has identified nearby noise-sensitive areas by distance from the proposed HDDs .	Sections 9.2.1 and 9.2-3 and Table 9.2-2, 9.2-7 Appendix 9G. NSAs are depicted on Figure 1-7.
Identify any applicable state or local noise regulations – 18 CFR § 380.12(k)(4)	Section 9.2
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 – 18 CFR § 380.12(k)(4)	Section 9.2.3, Table 9.2-9, 9.2-10, 9.2-11, 9.2-12, and 9.2-13, and Appendix 9B

ADDITIONAL INFORMATION	LOCATION ADDRESSED
Include climate information as part of the air quality information provided for the project area.	Section 9.1.1 and Appendix 9C
Identify potentially applicable federal and state air quality regulations.	Sections 9.1.2 and 9.1-4
Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for proposed pipelines and aboveground facilities.	Section 9.1.2, Tables 9.1-3, and Appendix 9A
Provide copies of state and federal applications for air permits.	N/A
Provide operation and fugitive emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and aboveground facilities.	Sections 9.1.3 and 9.1.7, Tables 9.1-4 and 9.1-5, and Appendix 9B
Provide air quality modeling for entire compressor stations.	N/A
Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	Sections 9.1.2 and 9.1.3
Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulation facilities, and drilling locations.	Section 9.2.1 and Appendix 9D
Identify any state or local noise regulations applicable to construction and operation of the project.	Section 9.2.1
Indicate whether construction activities would occur over 24-hour periods.	Section 9.2.3
Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	Sections 9.2.2 9.2.3, Tables 9.2-2, 9.2-3, and Appendices 9G, 9H, and 9I
Quantify operation noise from aboveground facilities, including blowdowns.	Section 9.2.4
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 9.2.6
14. Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	Sections 9.2.3

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Abbreviations and Acronyms

CAA	Clean Air Act
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon monoxide
CO_{2e}	Carbon dioxide equivalent
dB	Decibel
dB(A)	Decibel (A-weighted)
DOT	Department of Transportation
Dth/day	Dekatherms per day
EPA	Environmental Protection Agency
F	Fahrenheit
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse gas
HAP	Hazardous air pollutant
HDD	Horizontal directional drill
Hz	Hertz
IDNR	Iowa Department of Natural Resources
L_{eq}	Equivalent continuous sound level
L_{dn}	Day-night average sound level
NAAQS	National Ambient Air Quality Standards
NAC	Noise Area Classification
NDWEE	Nebraska Department of Water, Energy and Environment
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NNSR	Nonattainment Area New Source Review
Northern	Northern Natural Gas
NPPD	Nebraska Public Power District
NSA	Noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
Pb	Lead
PM	Particulate matter
$PM_{2.5}$	Particulate matter 2.5 microns or less
PM_{10}	Particulate matter 10 microns or less
ppb	Parts per billion
ppm	Parts per million
Project	Central Mainline Corridor Expansion Project
PSD	Prevention of Significant Deterioration
scf	standard cubic feet
SIP	State Implementation Plan
SO_2	Sulfur dioxide
STAR	Science to Achieve Results
VOC	Volatile Organic Compound

9.0 AIR AND NOISE QUALITY

Resource Report 9 details effects of the proposed Project to existing air and noise environments and describes proposed measures to mitigate the effects.

Northern owns and operates a natural gas transmission pipeline system and associated aboveground facilities, including pipelines and facilities in Iowa and Nebraska. Northern is proposing to construct the Project, which will consist of (1) install 9.03 miles of 20-inch-diameter Omaha 3rd branch line loop, (2) install 14.64 miles of 30-inch-diameter NPPD Princeton Road power station branch line, (3) install 2.48 miles extension of the 20-inch-diameter Des Moines C-line, (4) uprate of the 20-inch-diameter Des Moines C-line south loop, (5) install new compressor station near Clarion, Iowa, (6) modify five compressor stations in Iowa and Nebraska allowing bidirectional flow, (7) install NPPD Princeton Road power station meter station, (8) install aboveground facilities including a launcher, receiver, tie-in valve settings, and uprate ancillary equipment. All Project components are located in various counties in Nebraska and Iowa.

When placed in service, the proposed facilities will provide for incremental 535,360 Dth/day total winter volume and 525,026 Dth/day summer volume to serve residential, commercial and industrial customer market growth in Northern's Market Area.

Table 9.0-1 Pipeline Facilities

Component	Project Facility	Facility Description	County, State
Omaha 3rd branch line loop	9.03-mile pipeline	20-inch-diameter loop	Cass and Sarpy, NE
	Palmyra compressor station	Temporary compression site	Otoe, NE
NPPD Princeton Road power station branch line	14.64-mile pipeline	30-inch-diameter branch line	Gage and Lancaster, NE
	Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 Setting	Temporary compression site	Lancaster, NE
Des Moines C-line branch line extension	2.48-mile pipeline	20-inch-diameter extension	Dallas, IA
	Ogden compressor station	Temporary compression site	Boone, IA
Des Moines C-line south loop uprate	Royal Estates reducing station	Disconnect existing MAOP control valve	Polk, IA
	Grimes Iowa TBS	New MAOP regulator	Polk, IA
	Des Moines A-line launcher	New control valve	Polk, IA
Clarion compressor station	Proposed compressor station	ISO-rated 20,500-HP	Wright, IA
Beatrice compressor station	Facility modification	New scrubber install	Gage, NE
Guthrie Center compressor station	Facility modification	New piping and valves	Guthrie, IA

Component	Project Facility	Facility Description	County, State
Oakland compressor station	Facility modification	New piping and valves	Pottawattamie, IA
Ogden compressor station	Facility modification	New piping and valves	Boone, IA
Palmyra compressor station	Facility modification	New piping, valves and regulation	Otoe, NE

Table 9.0-2 Compressor Station and Aboveground Facilities

Facility Name	New/ Modified and Facility Type	Associated Pipeline Segment	MAOP (psig)	Approx. MP	County	State
Clarion compressor station	New	Stand-alone component	NA	NA	Wright	IA
Omaha 3rd branch line tie-over regulator	Expanded lot, new valve and launcher	Omaha 3rd branch line	991	0.00	Cass	NE
Omaha 3rd branch line loop receiver facility	New facility with receiver and valve	Omaha 3rd branch line	991	9.03	Sarpy	NE
Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 Setting	Existing facility – used for temporary compression	NPPD Princeton Road power station branch line	N/A	NA	Lancaster	NE
NPPD Princeton Road power station launcher facility	New facility with launcher and valves	NPPD Princeton Road power station branch line	1,000	0.00	Gage	NE
NPPD Princeton Road power station meter station	New meter station, receiver, valves and associated equipment	NPPD Princeton Road power station branch line	1,000	14.64	Lancaster	NE
Existing Des Moines north loop receiver (to be removed)	Relocated receiver remove valves and piping	Des Moines C-line branch line	960	16.07	Dallas	IA

Facility Name	New/ Modified and Facility Type	Associated Pipeline Segment	MAOP (psig)	Approx. MP	County	State
Proposed Des Moines north loop receiver	New facility with relocated receiver and new valves and piping	Des Moines C-line branch line	960	18.55	Dallas	IA
Royal Estates reducing station	Disconnect control valve from the Des Moines C-line branch line	Des Moines C-line south loop uprate (start of uprate)	960	18.55	Polk	IA
Des Moines A-line launcher facility	Install control valves and small building	Des Moines C-line south loop uprate (end up uprate)	960	25.38	Polk	IA
Grimes Iowa TBS	Install a MAOP regulators, valves and small building	Des Moines C-line south loop uprate	960		Polk	IA
Beatrice compressor station scrubber valve and pipe	New scrubber install	Stand-alone component	NA	NA	Gage	NE
Guthrie Center compressor station valve and pipe	New piping and valves	Stand-alone component	NA	NA	Guthrie	IA
Oakland compressor station valve and pipe	New piping and valves	Stand-alone component	NA	NA	Pottawattamie	IA
Ogden compressor station valve and pipe	New piping and valves	Stand-alone component and temporary compression for Des Moines C-line branch line	NA	NA	Boone	IA
Palmyra compressor station valve and pipe	New piping, valves and regulation	Stand-alone component and temporary compression for Omaha 3rd line	NA	NA	Otoe	NE

9.1 AIR QUALITY

9.1.1 Existing Air Quality

The CAA of 1970, 42 U.S. Code Part 7401 et seq., amended in 1977 and 1990, is the basic federal statute governing air quality. The provisions of the CAA that are potentially relevant to construction and operational emission sources include the following: NAAQS, PSD, NNSR, NSPS, NESHAP, and Title V Operating Permits.

Section 109(b) of the CAA requires that the EPA establish NAAQS "requisite to protect" public health and public welfare (40 CFR Part 50). The CAA identifies two class types of NAAQS: primary standards and secondary standards. Primary standards are limits set to protect the public health of the most sensitive populations such as asthmatics, children and the elderly. Secondary standards are limits set to protect public welfare such as protection against visibility impairment or damage to vegetation, wildlife and structures. The CAA requires the EPA to periodically review and, if new data indicate, update the NAAQS.

The EPA has promulgated NAAQS for six criteria pollutants: ozone, PM, SO_2, NO_2, CO, and Pb. Standards for PM are categorized on the size of the PM based on diameters of PM_{10} and $PM_{2.5}$. The NAAQS are summarized in Table 9.1-1.

Table 9.1-1 NAAQS for Criteria Pollutants

Pollutant	Primary Standard	Averaging Times	Secondary Standard
CO	9 ppm	8 hours	None
	35 ppm	1 hour	None
Lead	0.15 µg/m^3	Rolling 3-month average	Same as primary
NO_2	53 ppb	Annual (arithmetic mean)	Same as primary
	100 ppb	1 hour	None
PM_{10}	150 µg/m^3	24 hours	Same as primary
$PM_{2.5}$	9 µg/m3	Annual (arithmetic mean)	0.15 µg/m^3
	35 µg/m^3	24 hours	Same as primary
Ozone	0.070 ppm (2015 std.)	8 hours	Same as primary
SO_2	75 ppb	1 hour	-
	-	Annual (arithmetic mean)	10 ppb

Source: https://www.epa.gov/criteria-air-pollutants/naaqs-table

The EPA compares ambient air criteria pollutant measurements to NAAQS to assess the status of the air quality of regions within the U.S. The regions are generally defined on a county level basis. Based on these comparisons, regions are designated as being in one of the following categories for the criteria air pollutants:

- **Attainment.** A region is designated as in "attainment" if monitoring shows that ambient concentrations of a specific pollutant are less than or equal to NAAQS. An attainment area for a NAAQS that has been redesignated from nonattainment is classified as a "maintenance area" for a 10-year period to ensure that the air quality improvements are sustained.

- **Nonattainment.** If the NAAQS are exceeded for a pollutant, then the region is designated as in "nonattainment" for that pollutant. Nonattainment areas can be further classified based on the severity of the exceedance of the relevant standard.
- **Unclassifiable.** An area is designated as "unclassifiable" if the ambient air monitoring data are incomplete and do not support a designation of attainment or nonattainment.

Boone, Dallas, Guthrie, Polk, Pottawattamie, and Wright counties in Iowa and Cass, Gage, Lancaster, Otoe, and Sarpy counties in Nebraska, will be affected by air emissions from the construction of the proposed Project. Table 9.1-2 lists the counties impacted by the Project. The affected counties are designated "attainment" for each of the NAAQS pollutants.

Table 9.1-2 Counties Affected by Project

Project Component	Affected County and State
Omaha 3rd branch line loop	Cass and Sarpy, NE
NPPD Princeton Road power station branch line	Gage and Lancaster, NE
Des Moines C-line branch line extension	Dallas, IA
Des Moines C-line south loop uprate	Polk, IA
Clarion compressor station	Wright, IA
Beatrice compressor station scrubber valve and pipe	Gage, NE
Guthrie Center compressor station valve and pipe	Guthrie, IA
Oakland compressor station valve and pipe	Pottawattamie, IA
Ogden compressor station valve and pipe	Boone, IA
Palmyra compressor station valve and pipe	Otoe, NE

The proposed Project locations in Nebraska are located in the vicinity of Lincoln, Nebraska, which is located in Lancaster County and has been selected as representative for the Nebraska Project. The average annual mean temperature for Lancaster County is 51.7 degrees F, which ranges from a monthly average low of 14 degrees F in January to a monthly average high of 89 degrees F in July. The area receives 29.8 inches of precipitation per year. The annual precipitation includes an average of 22.8 inches of snowfall.

The proposed Project locations in Iowa are located in the vicinity of Ames, Iowa, which is located in Story County and has been selected as representative for the Iowa Project area. The average annual high temperature for Story County is 59.9 degrees F with an average low of 38.7 degrees F, which ranges from a monthly average low of 12 degrees F in January to a monthly average high of 85 degrees F in July. The area receives 35.4 inches of precipitation per year. The annual precipitation includes an average of 34.1 inches of snowfall.

The states of Iowa and Nebraska are required to develop a SIP to outline how the areas under their jurisdiction will attain and maintain ambient air concentration levels in compliance with the NAAQS. This section details how the Project will comply with the state requirements.

Federal Class I Areas are established by Congress and include wilderness areas and national parks. These areas are afforded special protection under the CAA. Once designated as a Class I Area, an area cannot be re-designated to a lower classification. Class I areas are allowed the smallest degree of air quality deterioration through the NSR permitting process.

Special consideration must be made in the permitting process when a Class I area is located near a proposed facility. No Class I Areas are located within 100 kilometers (62.13 miles) of the Project, which is the maximum distance that must be considered under the PSD program.

9.1.2 Construction Emissions

Construction of the Project will result in intermittent, temporary and localized emissions of criteria pollutants over the 36-month construction period. Northern is planning to commence the pipeline extension construction activities June 2027 for the Omaha 3rd branch line loop and the Des Moines C-line branch line extension along with the Des Moines C-line south loop uprate and the five compressor station modifications. June 2027, Northern will commence construction of the NPPD Princeton Road power station branch line extension and the Clarion compressor station. Construction activities along the pipelines, compressor station modifications, and at the uprate locations will result in emissions of fugitive dust from vehicular traffic, soil disturbance, emissions from natural gas, diesel- and gasoline-fired construction equipment, and emissions from pipeline venting. Large earth-moving equipment and other mobile sources are sources of combustion-related emissions, including criteria pollutants (i.e., NO_X, CO, VOCs, SO_2, PM_{10} and $PM_{2.5}$) and small amounts of HAPs. Air pollutants from the construction equipment will be limited to the immediate vicinity of the construction area and will be temporary. The Project, as planned, will require no blasting. In addition, Northern will not complete any open burning as part of site-clearing activities

These emissions generally include dust (PM_{10} and $PM_{2.5}$) generated from soil-disturbing activities such as earthmoving, wind erosion of disturbed areas, and vehicle traffic during construction. The amount of dust generated during construction will be a function of vehicle numbers and types, vehicle speeds, roadway characteristics, and precipitation events. Dust emissions will be greater during dry periods and in areas of fine-textured soils.

In accordance with 567 IAC 23.3(2)(c) and 129 NAC 15.003, a person shall take reasonable precautions to prevent PM from becoming airborne in quantities sufficient to cause a nuisance. PM should not remain visible beyond the property where it originates. The IDNR and NDEE may require reasonable measures including, but not limited to, use of water for control of dusts in construction operations; the grading of roads or the clearing of land; application of suitable materials such as asphalt, oil, water, or chemicals on unpaved roads, material stockpiles, and other surfaces which can give rise to airborne dusts; installation and use of containment or control equipment to enclose or otherwise limit the emissions resulting from the handling and transfer of dusty materials; covering, at all times when in motion, open-bodied vehicles transporting materials likely to give rise to airborne dusts; prompt removal of earth or other material from paved streets or to which earth or other material has been transported by trucking or earth-moving equipment; and reducing the speed of vehicles traveling over on-property surfaces as necessary to minimize the generation of airborne dusts.

Construction-related emission estimates are based on typical construction equipment, hours of operation, and vehicle miles traveled by the construction equipment and supporting vehicles for each Project component. Construction of the Project will generally take place during daytime hours. This schedule will allow equipment operators to assess

the presence of fugitive emissions and to implement abatement measures, as needed. Work will occur six days per week (Monday through Saturday) during daytime hours (7 a.m. to 10 p.m.). Some construction activities, including HDD pull back activities, tie-ins, testing and commissioning, pressure testing, inspections, electrical work requiring no heavy equipment, equipment delivery, concrete delivery, sandblasting, dewatering and stormwater maintenance, and other time sensitive construction activities may extend beyond daytime hours and into Sunday, as necessary. For the three pipeline segment tie-ins and the pipeline uprate, continuous compression will be required for several days; flaring will be required for one day, followed by minimal venting of the remaining natural gas. Northern will employ dust control measures, such as watering access roads and public roads, storage piles and disturbed surfaces, during construction and restoration. The addition of construction stone to unpaved areas also will mitigate dust emissions. Additional measures that may be employed include imposing vehicle speed restrictions on unpaved areas, using gravel tracking pads at egress points to remove dirt from tires and tracks and restoring disturbed areas following construction.

Construction also results in combustion emissions from diesel and gasoline-fueled vehicles used in various construction activities. Combustion-related emissions will include NO_x, CO, VOCs, SO_2, PM, and small amounts of HAPs. The EPA requires manufacturers of on- and off-road engines to certify their products to engine emission standards based on the year of manufacture. On-road equipment, like automobiles and pick-up trucks, have had a series of standards imposed since the 1970s.

Large construction equipment, such as a grader or a front-end loader, are generally powered by diesel engines. For diesel engines, the emission standards have been phased in over the past two decades in four steps, referred to as Tier 1 to Tier 4. The engine must comply with the emission standards in place based on the size of the engine for the year the engine was built and must comply with the appropriate standard throughout its useful life. The engine manufacturers must certify the engine emissions to the EPA. In 2010, the EPA required the sulfur concentration in diesel fuels be lowered from a historical concentration of 500 ppm to 15 ppm (ultra-low sulfur diesel fuel), which allows diesel engines to meet current Tier 4 emission requirements. Proper maintenance of construction equipment and use of low and ultra-low-sulfur diesel fuel will minimize engine emissions during Project construction. To reduce emissions from internal combustion engines, idling of construction vehicles will be minimized.

The fugitive dust from the construction activities and engine emissions from the construction equipment for the Project are summarized in Table 9.1-3. Identified fugitive dust emissions are expected to be one-time emissions occurring over the approximately nine months in 2027 and nine months in 2028. In this analysis, it was assumed that the construction equipment engines, on average, would comply with Tier 2 standards. To complete the tie-ins, Northern will vent the following pipeline sections:

- approximately five miles of 30-inch-diameter M590 D-line and 14 miles of 36-inch-diameter M590 E-Line from the NPPD Princeton Road power station branch line
- approximately 15 miles of 30-inch-diameter pipeline on the Omaha 3rd branch line loop
- approximately 16 miles of 20-inch-diameter pipeline on the Des Moines C-line

branch line

Where possible, the pressure of the pipelines will be reduced through drawdown and Northern will vent the remaining natural gas in the pipelines prior to the tie-ins. Northern plans to vent approximately 1.52 million scf of gas for the Project to complete tie-in activities.

Detailed calculations, including assumed quantities of equipment type for the Project, are provided in Appendix 9A. The modifications at the five existing compressor stations will not require any project-specific blowdowns nor will they emit significant construction emissions.

Table 9.1-3 Construction Emissions Summary for the Project

Description and County/State	Emissions (tons)								
	Criteria Pollutants						CO_{2e}	Formaldehyde	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Engine Emissions									
Cass/NE	8.3	1.8	0.6	0.00	0.3	0.3	404	0.1	0.1
Sarpy/NE	8.3	1.8	0.6	0.00	0.3	0.3	404	0.1	0.1
Gage/NE	13.9	3.1	1.0	0.01	0.5	0.5	673	0.1	0.2
Lancaster/NE	149.4	29.9	8.2	0.05	4.8	4.6	6,916	1	1.6
Otoe/NE	111.4	22.2	5.9	0.04	3.5	3.4	5,135	0.7	1.2
Boone/IA	-	-	-	-	-	-	-	-	-
Dallas/IA	97.2	19.6	5.6	0.03	3.1	3.1	4,551	0.7	1.1
Polk/IA	114.3	22.8	6.3	0.04	3.6	3.5	5,280	0.7	1.2
Wright/IA	4.6	0.9	0.3	0.00	0.2	0.1	219	0	0.1
Unpaved Roads[1,2]									
Cass/NE	-	-	-	-	1.6	0.2	-	-	-
Sarpy/NE	-	-	-	-	1.6	0.2	-	-	-
Gage/NE	-	-	-	-	2.6	0.3	-	-	-
Lancaster/NE	-	-	-	-	18.9	1.9	-	-	-
Otoe/NE	-	-	-	-	12.6	1.3	-	-	-
Boone/IA	-	-	-	-	-	-	-	-	-
Dallas/IA	-	-	-	-	13.1	1.3	-	-	-
Polk/IA	-	-	-	-	14.4	1.4	-	-	-
Wright/IA	-	-	-	-	0.5	0.1	-	-	-
Earthmoving[1,2]									
Cass/NE	-	-	-	-	0.7	0.1	-	-	-
Sarpy/NE	-	-	-	-	0.7	0.1	-	-	-
Gage/NE	-	-	-	-	0.7	0.1	-	-	-
Lancaster/NE	-	-	-	-	13.1	1.4	-	-	-
Otoe/NE	-	-	-	-	7.7	0.8	-	-	-
Boone/IA	-	-	-	-	-	-	-	-	-
Dallas/IA	-	-	-	-	2.3	0.2	-	-	-
Polk/IA	-	-	-	-	5.9	0.6	-	-	-

Description and County/State	Emissions (tons)								
	Criteria Pollutants						CO_{2e}	Formaldehyde	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Wright/IA	-	-	-	-	2.8	0.3	-	-	-
Temporary Compression									
Cass/NE	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Sarpy/NE	-	-	-	-	-	-	-	-	-
Gage/NE	0.3	0.0	0.0	0.00	0.0	0.0	14	0.0	0.0
Lancaster/NE	0.2	0.0	0.0	0.00	0.0	0.0	8.2	0.0	0.0
Otoe/NE	0.1	0.0	0.0	0.00	0.0	0.0	3.0	0.0	0.0
Boone/IA	0.1	0.0	0.0	0.00	0.0	0.0	4.7	0.0	0.0
Dallas/IA	-	-	-	-	-	-	-	-	-
Polk/IA	0.03	0.0	0.0	0.00	0.0	0.0	1.3	0.0	0.0
Wright/IA	-	-	-	-	-	-	-	-	-
Temporary Flaring									
Cass/NE	-	-	-	-	-	-	-	-	-
Sarpy/NE	-	-	-	-	-	-	-	-	-
Gage/NE	-	-	-	-	-	-	-	-	-
Lancaster/NE	0.8	3.8	8.1	0.01	0.1	0.1	1,500	0.0	0.0
Otoe/NE	0.3	1.4	3.0	0.00	0.0	0.0	549	0.0	0.0
Boone/IA	0.5	2.1	4.6	0.00	0.1	0.1	842	0.0	0.0
Dallas/IA	-	-	-	-	-	-	-	-	-
Polk/IA	-	-	-	-	-	-	-	-	-
Wright/IA	-	-	-	-	-	-	-	-	-
Venting for Tie-ins[1,2]									
Cass/NE	-	-	-	-	-	-	-	-	-
Sarpy/NE	-	-	-	-	-	-	-	-	-
Gage/NE	-	-	-	-	-	-	-	-	-
Lancaster/NE	-	-	1.6	-	-	-	458	-	-
Otoe/NE	-	-	1	-	-	-	286	-	-
Boone/IA	-	-	0.4	-	-	-	129	-	-
Dallas/IA	-	-	-	-	-	-	-	-	-
Polk/IA	-	-	-	-	-	-	-	-	-
Wright/IA	-	-	0.0	-	-	-	0.0	-	-
Total emissions									
Cass/NE	8.3	1.8	0.6	0.00	2.6	0.6	404	0.1	0.1
Sarpy/NE	8.3	1.8	0.6	0.00	2.6	0.6	404	0.1	0.1
Gage/NE	14.2	3.1	1	0.01	3.8	0.9	687	0.1	0.2
Lancaster/NE	150.4	33.7	17.9	0.06	36.9	8	8,882	1	1.6
Otoe/NE	111.8	23.6	9.9	0.04	23.8	5.5	5,973	0.7	1.2
Boone/IA	0.5	2.1	4.6	0.00	0.1	0.1	842	0.0	0.0
Dallas/IA	98	19.6	6	0.03	18.5	4.6	4,685	0.7	1.1

Description and County/State	Emissions (tons)								
	Criteria Pollutants						CO_{2e}	Formaldehyde	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Polk/IA	114.3	22.8	6.3	0.04	23.9	5.5	5,281	0.7	1.2
Wright/IA	4.6	0.9	0.3	0.00	3.5	0.5	219	0.0	0.1
Project Total	**510**	**109**	**47.2**	**0.18**	**116**	**26.3**	**27,377**	**3.4**	**5.6**

[1] Unpaved roads and earthmoving are a source of fugitive dust emissions from these operations, engine emissions from the equipment are included in engine emissions
[2] (-) means that pollutant does not apply

To minimize methane venting to the atmosphere during tie-in activities for the Project, Northern will utilize temporary compression followed by flaring on the three proposed pipeline segments. The use of a temporary compression and flaring will eliminate the need to vent approximately 56.5 million scf of natural gas to the atmosphere during tie-in.

The Project construction schedule will determine the period of time during which construction-related emissions will occur and also the total quantity of emissions. Construction is scheduled to begin June 2027 and be completed by November 2027 for the Des Moines C-line branch extension, the Omaha 3rd branch line loop, and Des Moines C-line branch line extension, the Des Moines South C-line loop uprate, and the five compressor station modifications. Construction on the NPPD Princeton Road branch line and the Clarion compressor station is scheduled to begin June 2027 and be completed by April 1, 2028.

Table 9.1-4 below provides a breakdown of emissions by year.

Table 9.1-4 CMC Project Emissions by Year

Year	Emissions (tons)[1]								
	Criteria Pollutants						CO_{2e}	Formalde-hyde	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Abandonment Emissions									
2027	355.4	74.8	29.0	0.12	75.3	17.8	18,276	2.4	3.9
2028	155.0	34.6	18.2	0.06	40.4	8.5	9,101	1.0	1.7
Project Total	**510**	**109**	**47.2**	**0.18**	**116**	**26.3**	**27,377**	**3.4**	**5.6**

(-) means that pollutant does not apply

During the construction period, some or all of the following work practices may be implemented:

- Cover or treat surfaces disturbed by construction activities with a dust suppressant until completion of activities at each site of disturbance
- Stabilize on-site unpaved roads and off-site unpaved access roads (e.g., using water or chemical stabilizer/suppressant)
- Restrict on-road vehicle speeds on unpaved roadways to 15 miles per hour
- Add construction stone to unpaved areas. Use gravel tracking pads at egress points to remove dirt from tires and tracks
- Restore disturbed areas following construction
- Sweep paved roads

Through the implementation of the work practices described above, and the short duration of the construction activities, the temporary emissions during construction of the Project will be minimal and the impact of these emissions will be localized. Therefore, it is anticipated that these emissions will not have a significant impact on air quality.

9.1.3 Operational Emissions

After the pipelines are in service, emissions from the pipelines and the related aboveground facilities will be low.

The operational sources of air emission will be from the Clarion compressor station, which include the following:

- One ISO-rated 20,500-HP Solar Titan 130-20502A natural gas-fired turbine;
- One 0.65-MMBtu per hour natural gas-fired fuel gas heating skid;
- Natural gas fired space heaters total heat input 0.42 MMBtu/hr;
- One 625 kW (908-HP) EPA-certified natural gas-fired backup electric generator; and,
- Facility fugitive VOC emissions.

Facility-wide maximum potential emission rates for the Clarion compressor station are summarized in Table 9.1-5. Maximum potential emission rates assume operation at full design output capacity for 365 days per year and 24 hours per day for the turbine and process piping, with the turbine operating for 30 days per year with an ambient temperature less than 0° F, at which temperature the emission rate for the turbine increases. Maximum potential emission rates assume 500 hours of operation per year for the backup generator. Potential emissions of criteria pollutants and HAPs are quantified using vendor data, EPA regulatory thresholds and/or EPA AP-42 emission factors for natural gas turbine compressor engine, generator engine and natural gas processing facilities. All criteria and HAPs emission rates are below Title V and NSR/PSD thresholds; therefore, the station is classified as a minor source, but will require a construction permit from the Iowa DNR prior to commencement of construction. The fuel gas heater, space heater, and back-up generator sizing are estimated based on previous project experience.

Table 9.1-5 Operational Emissions Summary for the Clarion Compressor Station

Description	Emissions (tons per year)								
	Criteria Pollutants						CO_{2e}	Single HAP	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Solar Titan 130 turbine	46.41	94.13	5.60	0.52	4.83	4.83	85,674	0.52	0.75
Fuel gas heater	0.53	0.45	0.03	0.003	0.04	0.04	636	0.004	0.01
Space heaters	0.17	0.07	0.01	0.001	0.01	0.01	215	0.001	0.003
Backup generator	1.00	2.00	0.50	0.001	0.09	0.09	213	0.10	0.14
Facility Fugitives	--	--	0.11	--	--	--	381	--	--
Maximum potential emissions	48.11	96.65	6.25	0.52	4.97	4.97	87,119	0.63	0.90
PSD/NSR major stationary source threshold	250.0	250.0	250.0	250.0	250.0	-	-	-	-

Description	Emissions (tons per year)								
	Criteria Pollutants						CO_{2e}	Single HAP	Total for All HAPS
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$			
Title V major source threshold	100.0	100.0	100.0	100.0	100.0	100.0	-	10.0	25.0

[1]- means the data is not applicable.

The Clarion compressor station will employ a blowdown system that will serve the Solar Titan 130 compressor turbine. The blowdown system will include a blowdown silencer. The compressor station will be designed such that a blowdown should occur for only half of all unit shutdowns. During the period of commissioning and testing of the station, it is estimated that a unit blowdown could occur three or four times per day and typically only during the daytime. During normal operation of the compressor station, after the commissioning period, a unit shutdown event will occur about 20 times per year, resulting in 10 blowdown events per year. For this evaluation, Northern estimates all 20 shutdown events per year would result in a blowdown to be conservative, with 52,250 scf of natural gas will be vented per compressor unit blowdown event at the Clarion Station. A blowdown is an infrequent event and a gas blowdown only occurs for a short time frame of approximately three to four minutes.

Northern estimates a full station blowdown event would release 606,500 scf of natural gas. Northern will cap the station piping and limit the required annual emergency shut down testing to vent only the compressor unit. A full blowdown event would not be a planned event. If a full blowdown were to occur, Northern will time and record the event as required by regulation. For the emission calculations, Northern has assumed that a full blowdown event may occur once every five years.

The total estimated blowdown emissions for Clarion compressor station of VOC and GHG are summarized in Table 9.1-6a below. The GHG emissions are reported in tons of CO_{2e}.

Table 9.1-6a Blowdown Emissions Summary for Clarion Compressor Station

Description	Average Annual Emissions (tons per year)	
	Volatile Organic Compounds (VOC)	CO_{2e}
Unit Blowdown	0.15	537.9
Full System Event	0.09	312.2
Annual Total	0.24	850.1

Northern has calculated the loss of methane, which is a GHG, through leaks associated with aboveground valves, flanges, and the operation of launchers/receivers. GHG emissions from the launcher/receiver and other aboveground facilities associated with the Project are summarized in Table 9.1-5. Assuming one pig run consisting of five launches every seven years, the GHG emissions (CO_2e) are calculated to be 75.5 tons per year; this volume assumes the entire launcher/receiver barrels will be vented to atmosphere. Operational emissions are summarized in Table 9.1-5. Northern has utilized recompression services during launching/receiving operations to reduce the amount of gas vented to atmosphere and may utilize for future launcher/receiving operations. Detailed calculations

for operational emissions by Project component are included in Appendix 9B. The Project will not result in new operational emissions at the five compressor station modification locations.

Table 9.1-6b Operational Fugitive Emissions Summary Pipeline Facilities

Facility Description and County/State	Annualized Emissions (tons per year)[1]	
	Methane (CH_4)	CO_{2e}
Launcher/Receiver		
Cass/NE	0.5	13.3
Sarpy/NE	0.5	13.3
Gage/NE	0.3	7.9
Lancaster/NE	0.7	17.8
Dallas/IA	0.5	13.3
Polk/IA	0.4	9.9
Subtotals for Launcher/Receiver	**2.9**	**75.5**
Other Aboveground Facility Fugitives[2]		
Polk/IA	0.4	9.9
Gage/IA	0.8	20.2
Guthrie/IA	0.8	18.9
Pottawattamie/IA	0.7	17.7
Boone/IA	0.3	7.6
Otoe/NE	0.5	12.6
Subtotals for Other Aboveground Facilities	**3.5**	**86.9**
Project Total	**6.4**	**162.4**

[1] Annualized Emissions – assumes one pig event every seven years, consisting of five pig launches/receipts per event
[2] Other aboveground facilities include aboveground valves and flanges (-) means that pollutant does not apply

9.1.4 Federal and State Regulations

9.1.4.1 New Source Review

Pre-construction air permitting programs that regulate the construction of new stationary sources of air pollution are commonly referred to as NSR. NSR can be divided into two groups: major NSR and minor NSR. Major NSR includes two programs: PSD and Nonattainment NSR. Both major NSR programs are established at the federal level and typically implemented by a state or local permitting body with EPA review when these local authorities have either delegated jurisdiction by EPA or have EPA-approved State Implementation Plan programs. The minor NSR permitting program regulates pollutants from sources that do not require PSD or Nonattainment NSR permits. The purpose of minor NSR permits is to prevent the construction of sources that would interfere with attainment or maintenance of a NAAQS or violate the control strategy in nonattainment areas. Also, minor

NSR permits often contain permit conditions to limit the sources' emissions to avoid the need for PSD analysis or Nonattainment NSR.

The Project includes construction of a new natural-gas fired turbine at the proposed Clarion compression station located in North Central Iowa in Wright County. At the Clarion compressor station, Northern also will install a new natural gas fired emergency generator and install a natural gas fired fuel gas heater. The proposed work at the Clarion compressor station is subject to pre-construction NSR permitting. The proposed Project will not trigger any requirements under PSD or NNSR and will be considered minor under the NSR rules. Northern intends to receive an air quality construction permit from the Iowa DNR prior to construction of the Project sources that are required to obtain a permit. Operational emissions for the turbine are included in Table 9.1-5.

9.1.4.2 New Source Performance Standards

The EPA has promulgated NSPS based on specific emission source categories, and they are organized by subparts of 40 CFR Part 60. Depending upon the type of emission source and applicable subpart, these standards may include emission limits, work practice standards, and requirements for monitoring, recordkeeping and reporting. NSPS apply to new, modified or reconstructed stationary sources that meet criteria established in 40 CFR 60.

Subpart OOOOb – Standards of Performance for Crude Oil and Natural Gas Facilities

Subpart OOOOb (Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After December 6, 2022) establishes emission standards and compliance schedules for the control of VOC emissions from affected facilities in the crude oil and natural gas production source category that commence construction, modification or reconstruction after December 6, 2022. This subpart is applicable to the proposed Clarion compressor station. Northern will install nitrogen driven valve operators as part of the Clarion compressor station construction and convert the existing block valve 7 to nitrogen driven valve operators.

Subpart KKKKa - Standards of Performance for Stationary Gas Turbines

EPA published NSPS KKKKa in the Federal Register on January 15, 2025. NSPS KKKKa is applicable to affected facilities that began construction, modification or reconstruction on December 13, 2024. The proposed turbine at the Clarion compressor station will be subject to NSPS KKKKa and intends to comply with the requirements.

Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (Subpart JJJJ) applies to stationary spark ignition engine manufacturers and owners/operators. For natural gas-fired emergency engines manufactured after January 1, 2009, the applicable emission limits for engines greater than 130 HP rated capacity are specified in Subpart JJJJ as follows:

- For NO_x, the limit is 2.0 grams per horsepower-hour or 160 parts per million by volume on a dry basis at 15% oxygen (O2);

- For CO, the limit is 4.0 grams per horsepower-hour or 540 parts per million by volume on a dry basis at 15% O2; and
- For VOCs, the limit is 1.0 grams per horsepower- hour or 86 parts per million by volume on a dry basis at 15% O2.

The proposed emergency generator at the Clarion compressor station will be subject to NSPS JJJJ and intends to comply with the requirements.

9.1.4.3 National Emission Standards for Hazardous Air Pollutants

The EPA has promulgated NESHAPs based on specific industrial and emission source categories. NESHAP applicability also depends on the major and area source designation of the facility in terms of HAPs. A major source of HAPs is a facility that has the potential to emit 10 tpy or more of a single HAP, or 25 tpy or more of a combination of HAPs. Facilities that have potentials less than these are classified as area sources. Depending upon the specific variables of the facility (including major/area status), the applicable standards may include employing control devices (emission limits), work practice standards, and requirements for monitoring, recordkeeping and reporting.

Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR Part 63 Subpart ZZZZ establishes national emission limitations and operating limitations for HAPs emitted from stationary reciprocating internal combustion engines located at major and area (minor) sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.

Subpart ZZZZ applies to the emergency natural gas fired engine. The proposed emergency engine generator at the Clarion compressor station will comply with the requirements of Subpart ZZZZ by meeting the requirements of NSPS Subpart JJJJ.

9.1.5 State Permit Program and Requirements

Air permits are required in Nebraska and Iowa for stationary sources that emit regulated air pollutants unless the emissions or sources are exempted. Iowa requires that stationary sources subject to NSPS or NESHAP requirements or those that exceed state permitting thresholds must obtain a state permit. Iowa state air permitting is required for the proposed turbine and emergency generator at the Clarion compressor station. The fuel gas heater and space heaters will be exempt from air permitting. The proposed flares are the only construction emissions sources that require state permitting in Iowa. The Project will obtain the required construction permit waivers or authorizations prior to operation of the flares. A copy of the air permit applications will be provided to FERC upon submittal to IDNR.

9.1.6 Clean Air Act General Conformity

The CAA contains the legislation that mandates the General Conformity rule to ensure that federal actions in nonattainment and maintenance areas do not interfere with a state's timely attainment of the NAAQS. 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) will 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 evaluations are not required for areas that are in attainment for NAAQS.

The Project is located in an attainment area for all pollutants of concern; therefore, a General Conformity analysis is not required.

9.1.7 Air Dispersion Modeling

Air dispersion modeling was performed for the proposed Clarion compressor station using version 24142 of AERMOD, the most advanced sequential Gaussian plume model sanctioned by the EPA. The meteorological data for the CSs was processed through the AERMOD meteorological preprocessor (AERMET), whose purpose is to compute boundary layer parameters used to estimate profiles of wind, turbulence, and temperature. AERMINUTE, a program within AERMET that is used to process 1-minute Automated Surface Observing Systems wind data available from the NCDC to generate hourly-averaged wind speed and wind direction observations or values to supplement the standard hourly observations, was used to process the meteorological data used with AERMOD for each CS.

The air dispersion modeling results are summarized in Table 9.1-7. Background modeling information is provided in Appendix 9J. Surface and upper air meteorological data for the five-year period of 2020 through 2024 was taken from the Mason City, IA airport (KMCW), which is approximately 75 km northwest of the Clarion compressor station.

A source impact analysis is a modeling analysis designed to show the allowable emissions from a project will not result in a violation of the NAAQS. The Significant Impact Levels (SILs) are used to determine if the ambient impact of a project is significant enough to warrant further review. If a project is below the SIL for a pollutant and averaging period, further analysis is not required.

Northern completed a modeling analysis to compare the results to the SILs and determine compliance with NAAQS. Results of the modeling analysis are listed in Table 9.1-7 for all required pollutants and averaging periods. The results of the modeling analysis demonstrate that the operation of the proposed Project at the Clarion compressor station will not cause or contribute to an exceedance of the NAAQS as the results for all pollutants and averaging periods are below the SIL or NAAQS. Additional modeling information is provided in Appendix 9J.

Table 9.1-7 Clarion Compressor Station AERMOD Results

Pollutant	Averaging Period	Project Impact ($\mu g/m^3$)	Class II Significant Impact Level ($\mu g/m^3$)	Background [a] ($\mu g/m^3$)	NAAQS Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS
NO_2 [b]	1-hour	22.94	7.5	13	32.45	188	17%
	Annual	0.89	1	4	N/A	100	N/A
CO	1-hour	271.90	500	7,600	N/A	40,000	N/A
	8-hour	242.03	2,000	3,300	N/A	10,000	N/A
PM_{10}	24-hour	8.46	5	55	61.58	150	41%
$PM_{2.5}$	24-hour	7.47	1.2	18	23.40	35	67%
	Annual	0.07	0.3	7.8	N/A	12	N/A
SO_2	1-hour	24.20	7.8	47	66.64	196	34%
	3-hour	1.40	25	47	N/A	1300	N/A

[a] Background concentrations are from the Iowa DNR website (Background Data | Department of Natural Resources)
[b] The modeled NO_2 impact represents the EPA Tier 2 method, assuming an 80% NO_2/NO_X ratio.
Note: $\mu g/m^3$ = micrograms per cubic meter, NAAQS = National Ambient Air Quality Standards, NO_2 = nitrogen dioxide, CO = carbon monoxide, PM_{10} = PM with an aerodynamic diameter of 10 microns or less, $PM_{2.5}$ = PM with an aerodynamic diameter of 2.5 microns or less, and SO_2 = sulfur dioxide.

9.1.8 Air Quality Mitigation Measures

Northern will employ dust control measures, such as watering access roads, storage piles and disturbed surfaces during construction and restoration. The addition of construction stone to unpaved areas also will mitigate dust emissions. Additional measures that may be employed include: imposing vehicle speed restrictions on unpaved areas, using gravel tracking pads at egress points to remove dirt from tires and tracks and restoring disturbed areas following construction.

Proper maintenance of construction equipment and use of ultra-low-sulfur diesel fuel will minimize engine emissions during Projects construction. To reduce emissions from internal combustion engines, idling of construction vehicles will be minimized.

9.1.9 Climate Change

Northern understands the value of discussing a project's GHG emissions as the FERC balances the benefits of a project, i.e., its demonstrated need and necessity against possible environmental impacts. Simply put, Northern believes responsible environmental management is good business; it benefits customers and improves the quality of the environment in which we live. Northern has programs to reduce methane, a contributor to greenhouse gas emissions. Appendix H contains a detailed discussion of the Project's GHG emissions, and a summary of that discussion is below.

Northern has adopted maintenance and engineering measures to minimize venting of natural gas, reducing methane emissions. The use of third-party portable compression to draw down line pressure resulted in a savings of 223.78 MMscf, of natural gas emitted in 2021; this equates to approximately 112,440 tons CO_2e. The use of hot taps reduces the length of a line that has to be blown down during maintenance. A line stop is inserted in the pipeline; a shorter length of pipe is blown down. Northern estimates this procedure

resulted in the avoidance of 124.7 MMscf of natural gas released to the atmosphere; this equates to approximately 62,650 tons CO_2e. During normal pipeline operations, pipeline equipment, such as regulating stations, compressor stations, and town border stations, are utilized to draw down line pressure when needed, avoiding the venting of 65.2 MMscf or approximately 32,750 tons CO_2e of natural gas. Northern also uses flaring of gas as an alternative to venting natural gas, resulting in an estimated 15.4 MMscf, or approximately 7,740 tons CO_2e, of natural gas vented.

All told, in 2021, through operational best practices alone Northern achieved a 94.4% in methane reduction savings through flaring (95.5 MMscf of gas saved v. 5.6 MMscf of gas released; 89.75% of methane savings through capped blowdowns (26.1 MMscf of gas saved v. 3.0 MMscf of gas released); 65.0% of methane savings through pipeline operations (38.5 MMscf of gas saved v. 20.7 MMscf of gas released; and 100% methane savings through the use of vapor recovery units (1.2 MMscf of gas saved v. 0 MMscf of gas released).

In 2022, Northern replaced a total of seven antiquated compressor units, one unit at the Brownfield, Texas, station, two units at the Spraberry, Texas, station, and four units at the Ogden, Iowa, station. In 2023, Northern installed a compressor blowdown system at the Sunray, Texas, compressor station to route natural gas that would otherwise be vented to the atmosphere to the station fuel header during blowdown activities; and in May 2023, Northern commenced construction to replace four units at the North Branch, Minnesota, compressor station. The North Branch updates are due to be completed in late 2025. In 2024, Northern installed one vapor recovery system at the Spraberry, Texas, compressor station. The vapor recovery system will capture natural gas packing leak emissions from multiple reciprocating compressors and compress the gas to the station fuel system. The compressors are newly installed units which have operating conditions that permit the packing recovery system to be implemented. Northern uses advanced technology, such as LiDAR (light detection and ranging), optimal Gas Imaging (OGI), and a HiFlow Sampler™ technology, to identify the source of fugitive leaks. Northern then assigns a priority to leaks in order to respond to the sources with the greatest level of fugitive gas.

9.2 NOISE QUALITY

9.2.1 Applicable Noise Guidelines

Sound is caused by vibrations that generate waves of pressure fluctuations in the surrounding medium. Sound levels are typically measured using a logarithmic dB scale as pressure fluctuations caused by sound sources can vary by several orders of magnitude. The logarithmic dB scale facilitates the comparison of different sound levels. Unwanted sound or sound that causes disturbance or annoyance is often called noise. The terms sound and noise are used interchangeably in this report.

Human hearing varies in sensitivity for different sound frequencies. The ear is most sensitive to sound frequencies between 800 and 8,000 Hz and is least sensitive to sound frequencies below 400 Hz or above 12,500 Hz. Consequently, several different frequency weighting schemes have been used to approximate the way the human ear responds to noise levels. The dB(A) is the most widely used for this purpose.

The L_{eq} is the steady sound energy level recorded and averaged over a specific period of interest such as hourly ($L_{eq, 1\text{-}hr}$), daytime ($L_{eq, day}$), nighttime ($L_{eq, night}$), or a 24-hour period. FERC defines daytime hours as the hours between 7 a.m. and 10 p.m., and nighttime hours as the hours between 10 p.m. and 7 a.m.

FERC regulations also refer to the day-night sound level (L_{dn}) to evaluate the noise impact of operation and construction activities on nearby NSAs. The L_{dn} is the L_{eq} plus 10 decibels added to nighttime levels to account for greater human sensitivity to noise during nighttime hours.

The L_{dn} is calculated according to the following formula:

$$L_{dn} = 10 \times Log_{10}\left(15/24 \times 10^{(L_{eq(day)}/10)} + 9/24 \times 10^{((L_{eq(night)}+10)/10)}\right)$$

FERC regulations at 18 CFR § 380.12(k)(2) require that any applicable state or local noise regulations be identified. It is further required at 18 CFR § 380.12 (k)(4)(v) to specify how the proposed Project will meet the regulations. In the absence of any applicable state or local noise regulation, FERC requires that noise attributable to any new compressor station, compression added to an existing station, or any modification, upgrade or update of an existing station, must not exceed an L_{dn} of 55 dBA at any pre-existing NSA. Northern will apply the noise standards to the proposed compressor station and construction activities including HDDs, temporary compression, and flaring.

FERC guidance states that construction activities that could or may occur during nighttime hours should be performed with the goal that the activity contribute noise levels at or below 55 dBA L_{dn} and 48.6 dBA $L_{eq, 24\text{-}hr}$, or no more than 10 dB over background if ambient noise levels are above 55 dBA L_{dn}. The human ear's threshold of perception for noise change is considered to be 3 dB; 6 dB is clearly noticeable to the human ear; and 10 dB is perceived as a doubling of noise.

In Nebraska and Iowa, noise standards are generally managed at the local level.

No applicable local noise regulations were found for Cass, Gage, Lancaster, Otoe, or Sarpy, counties in Nebraska. No applicable local noise regulations were found for Boone, Dallas, Guthrie, Polk, Pottawattamie, or Wright counties, Iowa. Northern will conduct construction and operational activities per FERC guidance.

9.2.2 Existing Noise Levels

Construction activities related to the Project are expected to have a noise impact on the ambient environment and nearby NSAs. The noise impact from the operation of the Project once completed is expected to be insignificant relative to ambient sound levels. The construction noise impacts will be associated with HDD activities along the Project corridor. Northern also evaluated noise levels at the four locations that will have temporary compression and/or flaring.

An assessment of the noise impact of the construction activities requires that existing baseline noise levels be quantified in the Project area. The applicable FERC guideline recommends that noise levels be representative of the existing conditions at NSAs which will be affected by HDDs, and temporary compression and/or flaring. The applicable FERC guideline requires Northern to quantitatively describe existing noise levels at NSAs.

Northern measured ambient noise levels at locations representative of NSAs along the Project route. The Project includes a mix of residential and agricultural areas. A summary of measurement methodology is provided in Attachment 9C. Ambient noise measurements consisting of short-term 20-minute sound level measurements were collected between February 16 and March 24, 2026, along the Project corridor. Measurements were collected in accordance with ANSI S12.9-1993/Part 3 "Quantities and Procedures for Description and Measurement of Environmental Sound, Part 3: Short-term measurements with an observer present" and ANSI S12.100-2014 "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas" where possible.

Field observations were used to evaluate the potential impact of weather on sound level measurements. Measurements were taken during periods where wind induced sound was ten dB below measured sounds levels, relative humidity was below 90%, and temperature was within the operating range of the sound level meter. Measurements were not taken during periods of precipitation.

Ambient background noise measurements were not collected at the Beatrice, Guthrie Center, and Oakland compressor station modifications nor at the Grimes Iowa TBS or Des Moines A-line launcher site of the Des Moines C-line south loop uprate. No significant noise impacts will occur at these locations. Appendix 9D contains a summary report of the ambient noise levels collected for the Project.

Northern has conservatively used the measured A-weighted L_{90} sound level to calculate the L_{dn} at measurement locations in Table 9.2-2.

Table 9.2-2 Background Ambient Sound Pressure Levels for the Monitoring Locations

Facility	Measurement Location	Measurement Date(s)	Measured Daytime (L_{90})[1] [dBA]	Measured Nighttime (L_{90})[1] [dBA]	Calculated L_{dn} [dBA]
Omaha 3rd branch line loop	OMA-ML-01	February 18, 2026	56	47	57
	OMA-ML-02	February 18, 2026	40	30[2]	40
	OMA-ML-03	February 18, 2026	38	28[2]	38
	OMA-ML-04	February 18, 2026	40	30[2]	40
	OMA-ML-05	February 18, 2026 February 19, 2026	34	24[2]	34
	OMA-ML-06	February 18, 2026 February 19, 2026	38	34	41
	OMA-ML-07	February 18, 2026 February 19, 2026	32	30	37
	OMA-ML-08	February 18, 2026 February 19, 2026	32	28	35
	OMA-ML-09	February 18, 2026 February 19, 2026	34	30	38

Facility	Measurement Location	Measurement Date(s)	Measured Daytime (L_{90})[1] [dBA]	Measured Nighttime (L_{90})[1] [dBA]	Calculated L_{dn} [dBA]
NPPD Princeton Road power station branch line	PRB-ML-01	February 16, 2026	34	27	35
	PRB-ML-02	February 16, 2026	31	21[2]	31
	PRB-ML-03	February 16, 2026	28	18[2]	28
	PRB-ML-04	February 16, 2026	30	20[2]	30
	PRB-ML-05	February 16, 2026	46	22	44
	PRB-ML-06	February 16, 2026 February 17, 2026	64	23	62
	PRB-ML-07	February 16, 2026	34	24[2]	34
	PRB-ML-08	February 16, 2026	32	22[2]	32
	PRB-ML-09	February 16, 2026	32	22[2]	32
Des Moines C-line branch line extension	DMS-ML-1	February 23, 2026	26	26	32
	DMS-ML-2	February 24, 2026	51	53	59
	DMS-ML-3	February 23, 2026	40	39	46
	DMS-ML-4	February 24, 2026	40	45	51
Clarion compressor station	CL-ML-1	March 24, 2026	38	29	39
	CL-ML-2	March 24, 2026	35	28	36
Ogden compressor station	OCS-ML-1	February 23, 2026	52	51	57
Palmyra compressor station	PCS-ML-1	February 16, 2026 February 18, 2026	39	30	39

[1]L_{90} sound levels were used in place of L_{eq} to calculate L_{dn} sound levels because they are considered to best represent ambient sound levels at NSAs.
[2]Nighttime levels are assumed to be 10 dB below daytime readings.

9.2.3 Construction Noise Impacts

Construction of the Project is expected to create noise impacts. Construction activities will represent an intermittent, temporary noise source. Construction of a pipeline typically involves installation of access roads, clearing and grubbing, delivery of materials, site grading and trenching, pipeline installation, HDD crossings, and restoration. The level of construction noise will vary over the entire construction period and will be highly dependent on the type of construction equipment being used at any given time. While construction is planned to occur over a seven-month period over several years, concentrated construction activities will only occur at periodic intervals.

Multiple HDDs are planned for the construction of the Project. The entry and exit pits of an HDD represent a continuous, localized noise source during the HDD. The installation of a single HDD may require several days of work depending on the length and complexity of the HDD. NSAs within 0.5 mile of the entrance and exit pits of the HDDs were identified using aerial imagery, land ownership records and field surveys. The tables in Appendix 9D summarize the NSA locations nearest each HDD location for the Project. An aerial showing

the locations of NSAs in the vicinity of the Project is included as Figure 1-7.

People at nearby residences and buildings will hear the construction noise but the overall impact will be short term. Northern will comply with FERC guidelines, which restrict HDDs occurring between 10 p.m. and 7 a.m. to a drilling noise impact at any pre-existing NSA to an L_{dn} of no more than 55 dBA. The project schedules have been developed assuming the majority of pipeline construction, including HDD operations, will occur primarily during daytime hours only (7 a.m. to 7 p.m.). Work will occur six days per week (Monday through Saturday) during daytime hours (7 a.m. to 10 p.m.). Some construction activities, including HDD pull back activities, tie-ins, testing and commissioning, pressure testing, inspections, electrical work requiring no heavy equipment, equipment delivery, concrete delivery, sandblasting, dewatering and stormwater maintenance, and other time sensitive construction activities may extend beyond daytime hours and into Sunday, as necessary. For the three pipeline segment tie-ins and the pipeline uprate, continuous temporary compression will be required for several days; flaring will be required for one day, followed by minimal venting of the remaining natural gas. HDDs may be conducted continuously (24 hours per day) and into Sunday, subject to local regulations, including overnight, at critical times such as during pullback of the pipe into the drill hole on longer drills, in complex drill setups, drills that require welding pipe sections together during pullback. Northern anticipates that two HDDs will require continuous operation beyond daytime hours to complete:

- OMA P4-6
- PRB P4-4

Northern obtained sound power ratings for HDD rigs and supporting equipment (mud pumps, bentonite mixing systems, and excavators) from equipment manufacturer specification sheets. For equipment where manufacturer sound power ratings were unavailable, sound power ratings for comparable equipment from the Federal Highway Administration (FHWA) construction noise handbook (FHWA 2011) were used. A summary of the sound power ratings for equipment at the entry pit is summarized in Table 9.2-3 and a summary of the sound power ratings for equipment at the exit pit is summarized in Table 9.2-4.

Table 9.2-3 Combined Equipment Sound Power at HDD Entry Pit

Equipment	Assumed Quantity Operating Simultaneously	Maximum Sound Power Level of Equipment (dBA)
HDD drilling rig[1]	1	104
Mud pump engines[1]	1	112
Mud cleaner	1	102
Shaker	1	108
Bentonite mixer[1]	1	92
Excavator[2]	1	104
	Total Sound Power Level [3]	**115**

[1] Vendor Specifications for HDD equipment from American Augers
[2] Federal Highway Administration, Federal Highway Administration Highway Construction Noise Handbook. U.S. Department of Transportation. July 5, 2011, http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook00.cfm

[3] Assumed operation time of excavator of 15 minutes during worst case hour

Table 9.2-4 Combined Equipment Sound Power at HDD Exit Pit

Equipment	Assumed Quantity Operating Simultaneously	Maximum Sound Power Level of Equipment (dBA)
HDD drilling rig[1]	1	104
Mud pump	1	98
Bentonite mixer[1]	1	92
Excavator[2]	1	104
	Total Sound Power Level[3]	**108**

[1] Vendor Specifications for HDD equipment from American Augers
[2] Federal Highway Administration, Federal Highway Administration Highway Construction Noise Handbook. U.S. Department of Transportation. July 5, 2011, http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook00.cfm
[3] Assumed operation time of excavator of 15 minutes during worst case hour

Northern determined the distance between the entry and exit pits for the proposed HDDs to the nearest NSAs for each component of the Project. The cumulative acoustical impact of the HDD operations at the pit entry and exit was evaluated at each of the identified NSAs, assuming the nearest pit to each NSA will be the entry pit and that a large HDD rig will be used for each HDD. These assumptions establish the worst-case condition for each HDD in the Project. Should field conditions require the HDD to be drilled in the opposite direction than currently being shown in the design drawings, no change in the noise analysis is required. The cumulative acoustical impact of HDD operations on identified representative NSAs was calculated using CADNA/A acoustic modelling software (Version 2025 MR1), published by Datakustik GmbH, configured to implement ISO-9613-2 environmental noise propagation algorithms.

The cumulative noise impacts for both daytime-only construction and 24-hour HDD operation are detailed below. Northern will monitor the actual sound impact levels at the HDD locations during the pilot and ream process to verify the sound assumptions utilized in this modelling and the recommended mitigation measures. The selection and size of the HDD equipment during the construction of the Project has not been made, so the actual equipment to be utilized may have substantially lower sound impacts if a smaller or more modern piece of equipment is selected. The cumulative noise impacts for both daytime-only construction and 24-hour HDD operation are provided in Appendix 9E.

Noise controls as presented in Appendix 9E are required to mitigate the noise impact of nighttime HDD operations. Should 24-hour construction at these locations be required, Northern will implement appropriate noise mitigation and conduct the HDDs with the goal of reducing noise impacts below an L_{dn} of 55 dBA. Factors such as multiple pullbacks, length of pullback, complexity of drill, and noise impacts on nearby NSAs will contribute to the decision to conduct 24-hour operation.

For the HDDs indicated in Appendix 9E that require mitigation methods beyond general work practices (see Footnote 3 of Appendix 9E tables) for 24-hour operation, Northern has calculated the mitigated noise impacts with the recommended mitigation measures. Northern will implement the recommended mitigation measures if nighttime work is required. In addition to implementing the recommended noise mitigation measures, Northern will offer temporary relocation to the affected residents.

According to studies performed by the U.S. DOT, almost all construction equipment has a noise level between 75 and 85 dBA at a distance of 50 feet (FHWA 2011). Northern is committed to implementing the noise mitigation measures noted in Appendix 9E. Northern has included specifications for the Behrens SK-8 Free-Standing Sound Barriers in Appendix 9C. For the Project, noise walls for the HDDs are generally approximately 20 feet in height. The noise barrier system must be a standalone noise barrier with either a minimum surface density of 2 lb/sf or a minimum STC rating of 25, and must be approved by Northern for use on the Project. The SK-8 barrier panels shown in Appendix 9C meet these requirements and these barriers, or equivalent, will be utilized on the Project. The site-specific HDD crossing figures in the HDD Plan (Appendix 1A) depict wall orientations and layouts at each HDD where barrier walls are required for mitigation.

9.2.4 Temporary Compression and Flaring for the Project

Northern will utilize three locations to evacuate gas from adjacent Northern mainlines to complete the tie-ins for the three proposed pipelines. This temporary compression will occur 24-hours a day for up to 48 hours while the flaring will only occur during daytime hours (one day for 15 hours maximum). Any natural gas remaining in the line will be vented following the flaring.

1. For the Omaha 3rd branch line loop, Northern will utilize its existing Palmyra compressor station for temporary compression. Approximately three portable natural-gas fired 300 HP units will be utilized for about 48 hours to reduce the pressure to approximately 25 psig. Northern will then use flaring to reduce the pressure to approximately 5 psig.
2. For the Des Moines C-line branch line extension and Des Moines C-line south loop uprate, Northern will utilize its existing Ogden compressor station for temporary compression. Approximately two portable natural-gas fired 300 HP units will be utilized for about 48 hours to reduce the pressure to approximately 25 psig. Northern will then use flaring to reduce the pressure to approximately 5 psig.
3. For the NPPD Princeton Road power station branch line, Northern will utilize its existing Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 setting location for temporary compression. Approximately four portable natural-gas fired 300 HP units will be utilized for about 48 hours to reduce the pressure to approximately 25 psig. Northern will then use flaring to reduce the pressure to approximately 5 psig.

Additionally, Northern will temporarily utilize one temporary compression unit at the Royal Estates reducing station for the Des Moines C-line south loop uprate. This temporary compression unit will be operated intermittently for a total of four hours in one 24-hour period. There will be no emissions or flaring at this location.

Northern will utilize existing station access roads and install mats for the compressor units. The mats and units will be removed following the flaring and venting. Northern's flaring stack height will be 40 feet or less to reduce visibility. Figure 1-10 in Resource Report 1 depicts the temporary compression locations that are not included on the alignment sheets.

Northern has identified representative NSAs within one mile of the temporary compression locations for each of the four proposed temporary compression sites and three proposed

flaring locations. An estimated sound power level of 111 dBA per 300 HP unit has been assumed for modelling of the temporary compression. An estimated sound power level of 126 dBA has been assumed for modelling of flare operation. A summary of NSAs and noise modelling results is presented as Appendix 9F and Appendix 9G, respectively.

The closest representative NSA (PCS-NSA07) to the Palmyra compressor station temporary compression and flaring activity is approximately 580 feet (0.11 mile) away. Mitigation is expected to be necessary for temporary compression noise impacts to comply with FERC limits. Mitigation for temporary compression will include a 250-foot-long, 24-foot-high, absorptive barrier along three sides of the work area. This noise wall should meet the following requirements: surface density of at least 2 lb/ft^2 or STC rating of at least 25, and an absorptive rating of at least NRC 0.7. Per FERC guidelines, mitigation for flaring is not required as it is solely a daytime activity. Flare operation is predicted to result in a maximum level of 68 dBA L_{dn} at the nearest NSA.

The closest representative NSA (OCS-NSA05) to the Ogden compressor station temporary compression and flaring activity is approximately 1300 feet (0.25 mile) away. Mitigation is expected to be necessary for temporary compression noise impacts to comply with FERC limits. Mitigation for temporary compression will include a 270-foot-long, 24-foot-high, barrier along three sides of the work area. This noise wall should meet the following requirements: surface density of at least 2 lb/ft^2 or STC rating of at least 25. Flare operation is predicted to result in a maximum level of 61 dBA L_{dn} at the nearest NSA and will not require mitigation.

The closest representative NSA (PRB-NSA59) to the Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 setting temporary compression and flaring activity is approximately 1200 feet (0.23 mile) away. Mitigation is expected to be necessary for temporary compression noise impacts to comply with FERC limits. Mitigation for temporary compression will include a 240-foot-long, 24-foot-high, absorptive barrier along three sides of the work area. This noise wall should meet the following requirements: surface density of at least 2 lb/ft^2 or STC rating of at least 25, and an absorptive rating of at least NRC 0.7. Flare operation is predicted to result in a maximum level of 60 dBA L_{dn} at the nearest NSA and will not require mitigation.

The closest representative NSA (RER-NSA01) to the Royal Estates reducing station temporary compression activity is approximately 420 feet (0.08 mile) away. Noise levels at the closest NSA are predicted to be 60 dBA L_{dn}. However, ambient sound levels in the area, at 59 dBA L_{dn}, represent the dominant sound at the NSA, while Project sound contributions are predicted to be much lower, at 51 dBA L_{dn}. Therefore, Project compliance with FERC limits is predicted to be achieved and mitigation is not required.

Estimated locations of the proposed noise barrier walls for the temporary compression are depicted in Resource Report 1, Figure 1-11.

9.2.5 Operational Noise Impacts

The operation of the launchers and receivers is not expected to create new operational noise impacts that would be discernable at NSAs upon completion of construction activities. Additionally, the compressor station modifications will not significantly increase noise impacts to be discernable at any nearby NSAs.

The operational noise sources will be limited to the NPPD Princeton Road power station meter station and the Clarion compressor station.

The operation of the proposed NPPD Princeton Road power station meter station is not expected to create new operational noise impacts upon completion of construction activities. At the nearest NSA, the cumulative noise impact of the meter station and existing ambient sound level is predicted to be 33 dBA L_{dn}, which is within FERC limits.

Operational noise sources at the Clarion compressor station will include the turbine air intake and exhaust, any sound transmitted through compressor building wall or roof openings, the backup generator, and unit blowdowns. The backup generator's operation is expected to be intermittent; therefore, it will not pose a significant impact. The unit blowdown was modeled for the station and is not expected to present a noise impact, as unit blowdown events occur infrequently and are of a short duration.

Operational noise will be moderated by the design of the compressor station, which includes enclosing the turbine within an insulated building, equipping the engine's air inlets and exhausts with silencers, and using a silencer on the unit blowdown. The walls and roof of the compressor buildings will be constructed of 24-gauge metal with all building interior surfaces covered with six-inch-thick high-density mineral wool. Personal and large access doors will be insulated, self-closing, and be well sealed when closed. The Solar exhaust and intake silencer systems will be implemented.

Based on information provided by the manufacturer of the compressor turbines, Northern developed estimates of the sound power from the operating compressor station equipment. Table 9.2-5 identifies the significant operational noise sources at the compressor station and their sound power levels. Table 9.2-6 specifies modelled insertion losses from turbine mitigation equipment.

Table 9.2-5 Sound Power Level of Significant Operational Noise Sources for the Clarion Compressor Station

Equipment	Sound Power Level									
	Level (dB) Per Octave Band Center Frequency (Hz)									Total (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Solar Titan 130 turbine[1]	118	117	125	122	119	115	116	128	121	130
Solar Titan 130 exhaust[2]	124	122	116	109	101	96	86	87	84	105
Solar Titan 130 air intake[3]	109	108	107	109	95	74	65	58	55	114
Blowdown stack[4]	115	117	110	104	94	91	90	89	61	101
Supply fan openings[5]	110	111	109	101	98	99	101	99	93	106
Rooftop exhaust openings[5]	110	111	109	101	98	99	101	99	93	106

[1] Unenclosed package, driver only; full load levels per revision 8 of PIB 252. Modelled as interior source only.
[2] Silenced exhaust, levels per revision 8 of PIB 252 document
[3] Silenced inlet, medium-velocity 3-stage inlet air cleaner; levels per revision 8 of PIB 252 document
[4] Stack with silencer
[5] Equipment assumed to be operating with louvers at fully open position. Sound levels are based on turbine levels and interior surface absorption.

Table 9.2-6 Modelled Insertion Losses from Mitigation at the Clarion Compressor Station

Equipment	Insertion Loss (dB) Per Octave Band Center Frequency (Hz)[1]								
	31.5	63	125	250	500	1000	2000	4000	8000
Turbine exhaust silencer	1	6	10	20	35	38	36	24	16
Turbine inlet silencer	0	1	4	7	26	43	52	60	55
Medium velocity 3-stage air inlet cleaner	0	1	1	4	7	12	27	29	33

[1] Per revision 8 of PIB 252 document

NSAs were identified within 1 mile of the Clarion Compressor Station. These NSAs are listed in Appendix 9H.

The noise impact analysis for the Clarion Compressor Station was conservatively performed assuming all significant noise sources are continuously operational at full capacity. This assumption allows for prediction of the worst-case noise impact at each NSA. A summary of the noise impact analysis results is provided in Appendix 9I. Detailed calculations for the analysis are located in Appendix 9B for all NSAs identified in Appendix 9H. The closest representative NSA (CCS-NSA06) to the Clarion compressor station is approximately 2670 feet (0.51 mile) away. Noise levels at the closest NSA are predicted to be 49 dBA L_{dn}. Therefore, Project compliance with FERC limits is predicted to be achieved and mitigation is not required.

9.2.6 Noise Mitigation Measures

Operational noise will be mitigated by the design of the compressor stations, which includes insulating the building and providing silencers on the turbine inlet and exhaust and on the unit blowdown. Access doors will be insulted and self-closing. If deemed necessary, acoustical pipe insulation will be used on above-grade, outdoor gas piping. Construction will occur primarily during daytime hours, which will mitigate the perceived noise impacts on nearby NSAs. Nighttime operations (10 p.m. to 7 a.m.) are possible as noted in Appendix 9E.

Northern will take steps to minimize engine idling and other non-essential noise generating activities. Northern will ensure that all combustion engine-driven machinery is equipped with mufflers. Northern will inform nearby residents of the Project and the upcoming construction activities, including HDD operation, and will respond to and investigate concerns. Northern's contractor will position equipment so noise propagates away from the nearest NSAs, and position non-noise generating equipment, such as the support vehicles, between the drilling operation and the nearby NSAs, where possible, to provide shielding. For the HDDs that may operate beyond daytime hours, Northern will implement the noise mitigation measures as described in Appendix 9E unless on-site monitoring concludes that the actual impacts are less than those modeled in this report due to the use of smaller or quieter equipment. A summary of noise mitigation measures for each project HDD is provided in Table 9.2-7

Table 9.2-7 Summary of Noise Mitigation Measures for HDDs

Pipeline Facility	Crossing Number/ Ref. Drawing	Drill Period	Duration of HDD (days)	Mitigation Measures for HDD, if 24-hour operation is required[1]
Omaha 3rd branch line loop	OMA-P4-1	Daytime Only	3	
	OMA-P4-2	Daytime Only	3	
	OMA-P4-3	Daytime Only	3	
	OMA-P4-4	Daytime Only	5	
	OMA-P4-5	Daytime Only	3	
	OMA-P4-6	Daytime and Nighttime	45	A
NPPD Princeton Road power station branch line	PRB-P4-1	Daytime Only	4	
	PRB-P4-2	Daytime Only	8	
	PRB-P4-3	Daytime Only	4	
	PRB-P4-4	Daytime and Nighttime	19	A, D
	PRB-P4-5	Daytime Only	5	
	PRB-P4-6	Daytime Only	9	
	PRB-P4-7	Daytime Only	9	

Notes:
[1] Mitigation Measures:
A. Institute work practices such as reduced idling or changes to equipment layout and orientation. A 3 dB drop in overall sound levels is assumed.
B. Utilize a smaller and modernized HDD rig compared to what is assumed in the modelling.
C. Install sound barrier walls between the entry pit and NSAs or a barrier wall between the exit pit and NSA, whichever is closest.
D. Install sound barrier walls between entry and exit pits and NSAs.
For options C and D, the minimum noise barrier wall height is 20 feet with a minimum surface density of 2 lb/ft^2 or a minimum STC rating of 25.

At the identified locations, the contractor will be required to reduce noise impacts on the NSA to below 55 dBA L_{dn} between the hours of 10 p.m. and 7 a.m., should the construction schedule require operation during this time period. Noise mitigation options may include, but are not limited to: positioning equipment so noise propagates away from the NSA; locating the entry pit to maximize distance to NSAs; the installation of temporary sound barriers between the HDD sites and nearby residences; the use of smaller and quieter HDD

equipment; the installation of sound enclosures around critical equipment such as the drill rig and shaker; or temporary relocation of the residents if HDD operations continue past 10 pm.

A summary of noise mitigation measures for each project temporary compression and flare operation is provided in Table 9.2-8. At the identified locations, the contractor will be required to reduce noise impacts on the NSA to below 55 dBA L_{dn} between the hours of 10 p.m. and 7 a.m., should the schedule require operation during this time period. Noise mitigation options may include, but are not limited to: positioning equipment so noise propagates away from the NSA; the installation of temporary sound barriers, potentially including absorptive barriers, between the temporary compression and nearby residences; the use of smaller and quieter temporary compression equipment; or temporary relocation of the residents if operations continue past 10 pm.

Table 9.2-8 Summary of Noise Mitigation Measures for Temporary Compression and Flaring

Pipeline Facility	Activity	Period	Duration	Mitigation Measures, if 24-hour operation is required
Palmyra compressor station	Temporary Compression	Daytime and Nighttime	48 Hours	Noise barrier wall required.[1, 2]
	Flare Operation	Daytime Only	15 Hours	
Ogden compressor station	Temporary Compression	Daytime and Nighttime	48 Hours	Noise barrier wall required.[1]
	Flare Operation	Daytime Only	15 Hours	
Beatrice to Palmyra D-line and Beatrice to Palmyra E-line block valve 5	Temporary Compression	Daytime and Nighttime	48 Hours	Noise barrier wall required.[1,2]
	Flare Operation	Daytime Only	15 Hours	
Royal Estates reducing station	Temporary Compression	Daytime and Nighttime	4 Hours	

Notes:
[1] The minimum noise barrier wall height is 24 feet with a minimum surface density of 2 lb/ft^2 or a minimum STC rating of 25.
[2] The minimum noise barrier absorption rating is an NRC of 0.7.

9.2.7 Vibration Impacts

The FERC guidance manual for Environmental Report Preparation references vibration assessment in the context of blasting during construction and vibrations generated by facility operations only. The FTA Noise and Vibration Impact Assessment Manual provides criteria summarized in Table 9.2-8, which may be applicable to the Project construction activities.

Table 9.2-8 Construction Vibration Damage Criteria

Building/Structural Category	PPV[1] (in/sec)
Reinforced concrete, steel or timber (no plaster)	0.5
Engineered concrete and masonry (no plaster)	0.3

Non-engineered timber and masonry buildings	0.2
Building extremely susceptible to vibration damage	0.12

[1]RMS velocity in decibels, Vdb re 1 micro-in/sec

Existing vibration levels are assumed to be insignificant compared to construction activities given the rural/urban nature of the Project area. Based on the equipment list, summarized in Table 9.2-9, vibration levels are anticipated to be below the FTA criteria.

Table 9.2-9 Equipment at HDD Pits

Equipment	Assumed Quantity Operating Simultaneously
HDD Drilling Rig	1
Mud Pump Engines	1
Mud Cleaner	1
Shaker	1
Bentonite Mixer	1
Excavator	1

Northern will take steps to minimize the impact of vibration, where possible, on nearby residences. Northern will inform nearby residents of the Project and the upcoming construction activities, including HDD operation and will respond and investigate concerns. Excavators and other heavy equipment must be used more than 50 feet from existing building structures, where possible. Northern's contractor will route heavily loaded trucks and equipment away from residential streets and vibration sensitive sites, where possible. Northern's contractor will sequence phases of construction activities such as earth-moving and ground impacting so as to not occur in the same time period and avoid nighttime activity.

Since compressor station noise sources that could cause a perceptible vibration, such as turbine exhaust noise, will be adequately mitigated and are located more than 2670 feet from the nearest NSA to any of the Clarion compressor station, there will not be any perceptible increase in vibration during compressor station construction and operation.

Vibration levels are highly dependent on the equipment models, modes of operation, and local ground conditions. Northern's contractor will monitor vibration levels at existing building structures if the 50-foot setback distance cannot be maintained due to site constraints. Preliminary analysis indicates that construction activities will not result in vibration levels near damage thresholds.

9.3 CUMULATIVE IMPACTS

9.3.5 Cumulative Air Quality Impacts

The impacts on air quality associated with the Project during construction, which includes fugitive dust, venting emissions, and combustion emissions from construction equipment and vehicles, will be short-term and localized and will subside after construction is complete.

While Northern has additional projects planned for Iowa and Nebraska, neither the geographic or temporal region of influence overlap with the proposed timeline for this Project. As noted above, impacts from construction related emissions are localized and short in duration. Moreover, operation of the pipeline facilities will result in limited emissions of methane, a GHG, which could have a negligible impact on climate change.

Operational emissions from the Project could result in cumulative impacts with emissions from Northern's existing facilities within a 0.5-mile radius as there are no major air emissions sources as part of the Project. However, the existing nearby facilities currently maintain air quality permits from the IDNR and NDWEE, and any modification or expansion would require a permit modification. Based on the limited emissions from the Project coupled with permitted nearby facilities, Northern concludes that there will not be a significant cumulative impact on air quality during operation of the Project.

9.3.6 Cumulative Noise Impacts

Construction noise associated with the Project will be temporary and minor. Based on the distance of the unrelated projects listed in section 1.9 and taking into account noise attenuation and adherence to FERC's noise requirement of an Ldn of 55 dBA, the cumulative noise impact associated with construction noise will be limited. The operation of the Project is not expected to create on-going operational noise impacts upon completion of construction activities.

9.4 REFERENCES

American National Standard: *Quantities and Procedures for Description and Measurement of Environmental Sound, Part 3: Short-term measurements with an observer present*; ANSI/ASA S12.9-1993/Part 3 dated November 12, 1993.

American National Standard: *Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas*; ANSI/ASA S12.100-2014 dated December 5, 2014.

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Appendix 9A
Detailed Calculation Sheets for Construction Emissions

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Purge Emissions tons	TOTAL tons
CO	0.9	0.0				0.9
NO_x	4.6	0.0				4.6
PM_{10}	0.2	0.0	0.5	2.8		3.4
$PM_{2.5}$	0.1	0.0	0.1	0.3		0.5
SO_2	0.00	0.00				0.00
VOC	0.3	0.0			0.0	0.3
Individual HAP	0.0	0.0				0.0
Combined HAP	0.1	0.0				0.1
Methane	0.0	0.0			0.0	0.0
Nitrogen Dioxide	0.0	0.0				0.01
CO_2	217	0				217
CO_{2e}	219	0			0	219

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Dump Truck	4	72	6	1728	325	0.59	192
Front End Loaders	2	72	6	864	196	0.59	116
Grader	1	72	6	432	140	0.64	90
Pickup Trucks	8	72	6	3,456	250	0.59	148
Skid Steer Loader	2	72	6	864	75	0.59	44

Assume a couple week schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Dump Truck	1,728	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.06	0.31	1.58	0.05	0.05	0.00	71	0.00	0.00	71
Front End Loaders	864	116	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.03	0.08	0.44	0.01	0.01	0.00	21	0.00	0.00	22
Grader	432	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.01	0.04	0.17	0.01	0.01	0.00	8	0.00	0.00	8
Pickup Trucks	3,456	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.17	0.42	2.25	0.07	0.07	0.00	109	0.01	0.00	110
Skid Steer Loader	864	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.02	0.10	0.20	0.01	0.01	0.00	8	0.00	0.00	8
Wright County, IA												0.3	0.9	4.6	0.2	0.1	0.0	217.2	0.0	0.0	219.2
TOTALS												0.3	0.9	4.6	0.2	0.1	0.00	217	0.012	0.006	219

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.0
Acetaldehyde	0.053	0.0
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0
TOTAL HAPS		0.1

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Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Grader	1	6	6	54	20	2	1.840	0.184	0.05	0.00
Pickup Trucks	8	6	6	1,440	2	8	0.653	0.065	0.47	0.05

Wright County, IA	0.52	0.05
TOTALS	0.52	0.05

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	1608	72		0.037	0.0039	2.14	0.22
Backfilling trench	1447	72		0.012	0.0013	0.63	0.07
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.00	0.00

Wright County, IA	2.8	0.3
TOTALS	2.77	0.29

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): Not Applicable
Topsoil removal (roads/laydown): Not applicable
Trench excavation and loading: 1,250,000 cu. ft., 1.25 tons per yard = 1,608 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Purge Emissions tons	Temp Flare Emissions tons	TOTAL tons
CO	22.2	0.0				1.4	23.6
NO_x	111.4	0.1				0.3	111.8
PM_{10}	3.5	0.0	12.6	7.7		0.0	23.9
$PM_{2.5}$	3.4	0.0	1.3	0.8		0.0	5.5
SO_2	0.04	0.00				0.00	0.05
VOC	5.9	0.0			1.0	3.0	9.9
Individual HAP	0.7	0.0				0.0	0.7
Combined HAP	1.2	0.0				0.0	1.2
Methane	0.3	0.0			11.5	0.6	12.4
Nitrogen Dioxide	0.1	0.0				0.0	0.14
CO_2	5,089	2				530	5,621
CO_{2e}	5,135	3			286	549	5,973

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Air Compressor	3	72	28	6048	310	0.56	174
All Terrain Vehicle (ATV)	5	72	28	10080	18	1.00	18
Backhoe	4	72	28	8064	75	0.21	16
Cuttings Cleaner System	3	72	28	6048	300	0.59	177
Dozers	4	72	28	8064	410	0.59	242
Dump Truck	12	72	28	24192	325	0.59	192
Generators	5	72	28	10080	430	0.68	292
Grader	2	72	28	4032	140	0.64	90
HDD Rig	2	72	28	4032	600	0.59	354
Mudd Unit	2	72	28	4,032	400	0.21	84
Pickup Trucks	13	72	28	26,208	250	0.59	148
Pipe Tractor Trailer	3	72	28	6,048	400	0.59	236
Scrapper	3	72	28	6,048	488	0.59	288
SideBoom	4	72	28	8,064	240	0.59	142
Trackhoe	4	72	28	8,064	320	0.21	67
Water / Fuel Truck	3	72	28	6048	250	0.59	148
Welding Machine	4	72	28	8064	35	0.21	7
Welding Rig	6	72	28	12096	10	0.21	2
X-Ray Truck/Machine	3	72	28	6048	50	0.21	11

Assume seven month schedule, four weeks per month, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Air Compressor	6,048	174	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.19	0.98	5.02	0.15	0.15	0.00	224	0.01	0.01	226
All Terrain Vehicle (ATV)	10,080	18	0.4380	2.1610	4.44	0.267	0.259	0.002	194	0.011	0.005	0.09	0.43	0.89	0.05	0.05	0.00	39	0.00	0.00	39
Backhoe	8,064	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.05	0.33	0.66	0.03	0.03	0.00	27	0.00	0.00	27
Cuttings Cleaner System	6,048	177	0.1669	0.8425	4.00	0.132	0.128	0.002	194	0.011	0.005	0.20	0.99	4.72	0.16	0.15	0.00	228	0.01	0.01	230
Dozers	8,064	242	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.36	1.81	9.32	0.28	0.27	0.00	416	0.02	0.01	420
Dump Truck	24,192	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.85	4.31	22.17	0.67	0.65	0.01	990	0.06	0.03	999
Generators	10,080	292	0.3085	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	1.00	2.74	14.08	0.43	0.41	0.01	629	0.04	0.02	635
Grader	4,032	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.13	0.35	1.63	0.05	0.05	0.00	77	0.00	0.00	78
HDD Rig	4,032	354	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.26	1.33	6.82	0.21	0.20	0.00	305	0.02	0.01	307
Mudd Unit	4,032	84	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.06	0.31	1.62	0.05	0.05	0.00	72	0.00	0.00	73
Pickup Trucks	26,208	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	1.31	3.19	17.04	0.56	0.54	0.01	825	0.05	0.02	832
Pipe Tractor Trailer	6,048	236	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.26	1.33	6.82	0.21	0.20	0.00	305	0.02	0.01	307
Scrapper	6,048	288	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.32	1.62	8.32	0.25	0.25	0.00	372	0.02	0.01	375
SideBoom	8,064	142	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.39	0.94	5.03	0.17	0.16	0.00	244	0.01	0.01	246
Trackhoe	8,064	67	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.10	0.50	2.59	0.08	0.08	0.00	116	0.01	0.00	117
Water / Fuel Truck	6,048	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.30	0.74	3.93	0.13	0.13	0.00	190	0.01	0.00	192
Welding Machine	8,064	7	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.02	0.10	0.31	0.02	0.02	0.00	13	0.00	0.00	13
Welding Rig	12,096	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.02	0.12	0.12	0.01	0.01	0.00	5	0.00	0.00	5
X-Ray Truck/Machine	6,048	11	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.02	0.11	0.33	0.02	0.02	0.00	14	0.00	0.00	14
Otoe County, NE			5.9	22.2	111.4	3.5	3.4	0.0	5088.6	0.3	0.1	5135.0									
TOTALS			5.9	22.2	111.4	3.5	3.4	0.04	5,089	0.289	0.131	5,135									

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.1
Formaldehyde	0.118	0.7
Acetaldehyde	0.053	0.3
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0
TOTAL HAPS		1.2

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Appendix 9A - Construction Emission Calculations

Table 9A-4 Temporary Compression Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x1)	46	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.00	0.01	0.06	0.00	0.00	0.00	2	0.03	0.00	3
Otoe County, NE												0.0	0.0	0.1	0.0	0.0	0.0	1.9	0.0	0.0	2.6
TOTALS												0.0	0.0	0.1	0.0	0.0	0.00	2	0.025	0.000	3

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.0
Formaldehyde	0.055	0.0
Benzene	0.002	0.0
1,3-Butadiene	0.001	0.0
Acrolein	0.008	0.0
TOTAL HAPS		0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
All Terrain Vehicle (ATV)	5	6	28	4,200	0.25	10	0.256	0.026	0.54	0.05
Backhoe	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Dozers	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Grader	2	6	28	504	20	2	1.840	0.184	0.46	0.05
Pickup Trucks	13	6	28	10,920	2	8	0.653	0.065	3.56	0.36
Pipe Tractor Trailer	3	6	28	756	2	8	0.653	0.065	0.25	0.02
Scrapper	3	6	28	756	30	2	2.208	0.221	0.83	0.08
SideBoom	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Trackhoe	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Water / Fuel Truck	3	6	28	2,520	30	8	2.208	0.221	2.78	0.28
Welding Rig	6	6	28	1,512	2	5	0.653	0.065	0.49	0.05

Otoe County, NE	12.63	1.26
TOTALS	12.63	1.26

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	328	72		0.058	0.0061	0.69	0.07
Topsoil removal by Scrapper for Access Roads, Laydown Yards	6	72		0.058	0.0061	0.01	0.00
Trench excavation and loading to storage piles	355	72		0.037	0.0039	0.47	0.05
Backfilling trench	319	72		0.012	0.0013	0.14	0.01
Topsoil replacement	301	72		0.012	0.0013	0.13	0.01
Wind Erosion Exposed Areas			84	0.38	0.0399	6.27	0.66

Otoe County, NE	7.7	0.8
TOTALS	7.71	0.81

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 9.03 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 328 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 9.03 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 355 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-7 Pipeline Interconnect Purge Emission Estimates

Operation	Blowdown Type	Blowdown loss per Type (scf)	Density of Natural Gas (lb/scf)	% VOC in Nautral Gas	VOC Emissions (ton)	Methane Emissions (ton)	Methane Emissions (ton CO2e)
Adam Palmyra CS Omaha	One-time Purge	498,000	0.050	8%	1.0	11.5	286
			TOTAL		1	11	286

Note 1: Northern estimates the loss of 0.4 million scf of natural gas as pressure is drawn down in the pipe being connected.

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Appendix 9A - Construction Emission Calculations

Table 9A-8 Temporary Flare Emissions

Equipment	Operating Schedule			Flare Capacity	Gas Purged	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
	Quantity	Hrs/Wk	Weeks Used	MMBtu/Hr	MMBTU	VOC[1]	CO[1]	NOx[1]	PM_{10}[2]	$PM_{2.5}$[2]	SO_2[2]	CO_2[2]	Methane[1]	N_2O[2]	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
FA-E Protego (Hero Flare)	1	10	1	850	518.16	0.66	0.31	0.068	0.007	0.007	0.001	118	0.140	0.002	2.98	1.40	0.31	0.03	0.03	0.00	530	0.63	0.01	549
Otoe County, NE															3.0	1.4	0.3	0.0	0.0	0.0	530.5	0.6	0.0	549.2
TOTALS															3.0	1.4	0.3	0.0	0.0	0.00	530	0.631	0.010	549

[1] EPA AP-42, Fifth Edition, Volume I Chapter 13: Industrial Flares, Section 13.5, Tables 13.5-1 & 13.5-2
[2] EPA AP-42, Fifth Edition, Volume I Chapter 1: External Combustion Sources, Section 1.4, Tables 1.4-2 & 1.4-3

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors[2] (lb/mmbtu)	Emissions (ton/yr)
Formaldehyde	0.0001	0.00
Benzene	0.000	0.00
Hexane	0.002	0.01
Toluene	0.000	0.00
TOTAL HAPS		0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	TOTAL tons
CO	1.8	0.0			1.8
NO_x	8.3	0.0			8.3
PM_{10}	0.3	0.0	1.6	0.7	2.5
$PM_{2.5}$	0.3	0.0	0.2	0.1	0.5
SO_2	0.00	0.00			0.00
VOC	0.6	0.0			0.6
Individual HAP	0.1	0.0			0.1
Combined HAP	0.1	0.0			0.1
Methane	0.0	0.0			0.0
Nitrogen Dioxide	0.0	0.0			0.01
CO_2	400	0			400
CO_{2e}	404	0			404

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Backhoe	1	72	12	864	75	0.21	16
Crane, Wheeled	1	72	12	864	715	0.47	336
Pickup Trucks	12	72	12	10,368	250	0.59	148
Skid Steer Loader	1	72	12	864	75	0.59	44
Welding Rig	2	72	12	1728	10	0.21	2

Assume a 3 month schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Backhoe	864	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.01	0.04	0.07	0.00	0.00	0.00	3	0.00	0.00	3
Crane, Wheeled	864	336	0.1669	1.3272	4.10	0.132	0.128	0.002	194	0.011	0.005	0.05	0.42	1.31	0.04	0.04	0.00	62	0.00	0.00	63
Pickup Trucks	10,368	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.52	1.26	6.74	0.22	0.22	0.00	326	0.02	0.01	329
Skid Steer Loader	864	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.02	0.10	0.20	0.01	0.01	0.00	8	0.00	0.00	8
Welding Rig	1,728	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.00	0.02	0.02	0.00	0.00	0.00	1	0.00	0.00	1

Cass County, NE	0.6	1.8	8.3	0.3	0.3	0.0	400.0	0.0	0.0	403.7
TOTALS	0.6	1.8	8.3	0.3	0.3	0.00	400	0.023	0.010	404

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.1
Acetaldehyde	0.053	0.0
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0

TOTAL HAPS	0.1

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Backhoe	1	6	12	108	20	2	1.840	0.184	0.10	0.01
Pickup Trucks	12	6	12	4,320	2	8	0.653	0.065	1.41	0.14
Welding Rig	2	6	12	216	2	5	0.653	0.065	0.07	0.01

Cass County, NE	1.58	0.16
TOTALS	1.58	0.16

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	386	72		0.037	0.0039	0.51	0.05
Backfilling trench	347	72		0.012	0.0013	0.15	0.02
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.00	0.00

Cass County, NE	0.7	0.1
TOTALS	0.66	0.07

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.09 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 76 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.09 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 83 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	TOTAL tons
CO	1.8	0.0			1.8
NO_x	8.3	0.0			8.3
PM_{10}	0.3	0.0	1.6	0.7	2.5
$PM_{2.5}$	0.3	0.0	0.2	0.1	0.5
SO_2	0.00	0.00			0.00
VOC	0.6	0.0			0.6
Individual HAP	0.1	0.0			0.1
Combined HAP	0.1	0.0			0.1
Methane	0.0	0.0			0.0
Nitrogen Dioxide	0.0	0.0			0.01
CO_2	400	0			400
CO_{2e}	404	0			404

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Backhoe	1	72	12	864	75	0.21	16
Crane, Wheeled	1	72	12	864	715	0.47	336
Pickup Trucks	12	72	12	10,368	250	0.59	148
Skid Steer Loader	1	72	12	864	75	0.59	44
Welding Rig	2	72	12	1728	10	0.21	2

Assume a 3 month schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Dump Truck	0	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Front End Loaders	0	116	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Grader	0	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Pickup Trucks	10,368	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.52	1.26	6.74	0.22	0.22	0.00	326	0.02	0.01	329
Skid Steer Loader	864	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.02	0.10	0.20	0.01	0.01	0.00	8	0.00	0.00	8
Welding Rig	1,728	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.00	0.02	0.02	0.00	0.00	0.00	1	0.00	0.00	1
Sarpy County, NE												0.6	1.8	8.3	0.3	0.3	0.0	400.0	0.0	0.0	403.7
TOTALS												0.6	1.8	8.3	0.3	0.3	0.00	400	0.023	0.010	404

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.1
Acetaldehyde	0.053	0.0
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0
TOTAL HAPS		0.1

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Backhoe	1	6	12	108	20	2	1.840	0.184	0.10	0.01
Pickup Trucks	12	6	12	4,320	2	8	0.653	0.065	1.41	0.14
Welding Rig	2	6	12	216	2	5	0.653	0.065	0.07	0.01

Sarpy County, NE	1.58	0.16
TOTALS	1.58	0.16

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	386	72		0.037	0.0039	0.51	0.05
Backfilling trench	347	72		0.012	0.0013	0.15	0.02
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.00	0.00

Sarpy County, NE	0.7	0.1
TOTALS	0.66	0.07

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.09 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 76 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.09 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 83 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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NPPD Princeton Road Power Station Branch Line (2027)
Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Purge Emissions tons	TOTAL tons
CO	27.9	0.0				27.9
NO_x	139.7	0.2				139.8
PM_{10}	4.5	0.0	17.3	12.4		34.2
$PM_{2.5}$	4.3	0.0	1.7	1.3		7.4
SO_2	0.05	0.00				0.05
VOC	7.6	0.0			1.6	9.2
Individual HAP	0.9	0.0				0.9
Combined HAP	1.5	0.0				1.5
Methane	0.4	0.1			18.3	18.8
Nitrogen Dioxide	0.2	0.0				0.17
CO_2	6,388	6				6,394
CO_{2e}	6,446	8			458	6,912

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NPPD Princeton Road Power Station Branch Line (2027)
Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Air Compressor	4	72	28	8064	310	0.56	174
All Terrain Vehicle (ATV)	6	72	28	12096	18	1.00	18
Backhoe	5	72	28	10080	75	0.21	16
Cuttings Cleaner System	4	72	28	8064	300	0.59	177
Dozers	5	72	28	10080	410	0.59	242
Dump Truck	10	72	28	20160	325	0.59	192
Generators	6	72	28	12096	430	0.68	292
Grader	5	72	28	10080	140	0.64	90
HDD Rig	3	72	28	6048	600	0.59	354
Mudd Unit	4	72	28	8,064	400	0.21	84
Pickup Trucks	14	72	28	28,224	250	0.59	148
Pipe Tractor Trailer	4	72	28	8,064	400	0.59	236
Scrapper	4	72	28	8,064	488	0.59	288
SideBoom	8	72	28	16,128	240	0.59	142
Trackhoe	8	72	28	16,128	320	0.21	67
Water / Fuel Truck	4	72	28	8064	250	0.59	148
Welding Machine	8	72	28	16128	35	0.21	7
Welding Rig	6	72	28	12096	10	0.21	2
X-Ray Truck/Machine	4	72	28	8064	50	0.21	11

Assume seven month schedule, four weeks per month, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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NPPD Princeton Road Power Station Branch Line (2027)
Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Air Compressor	8,064	174	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.26	1.30	6.69	0.20	0.20	0.00	299	0.02	0.01	301
All Terrain Vehicle (ATV)	12,096	18	0.4380	2.1610	4.44	0.267	0.259	0.002	194	0.011	0.005	0.11	0.52	1.07	0.06	0.06	0.00	46	0.00	0.00	47
Backhoe	10,080	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.06	0.41	0.82	0.04	0.04	0.00	34	0.00	0.00	34
Cuttings Cleaner System	8,064	177	0.1669	0.8425	4.00	0.132	0.128	0.002	194	0.011	0.005	0.26	1.33	6.29	0.21	0.20	0.00	305	0.02	0.01	307
Dozers	10,080	242	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.45	2.26	11.65	0.35	0.34	0.00	520	0.03	0.01	525
Dump Truck	20,160	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.71	3.59	18.47	0.56	0.54	0.01	825	0.05	0.02	832
Generators	12,096	292	0.3085	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	1.20	3.28	16.90	0.51	0.50	0.01	755	0.04	0.02	761
Grader	10,080	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.34	0.86	4.08	0.13	0.13	0.00	193	0.01	0.00	194
HDD Rig	6,048	354	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.39	1.99	10.23	0.31	0.30	0.00	457	0.03	0.01	461
Mudd Unit	8,064	84	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.12	0.63	3.24	0.10	0.10	0.00	145	0.01	0.00	146
Pickup Trucks	28,224	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	1.42	3.43	18.36	0.60	0.59	0.01	888	0.05	0.02	896
Pipe Tractor Trailer	8,064	236	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.35	1.77	9.09	0.28	0.27	0.00	406	0.02	0.01	410
Scrapper	8,064	288	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.43	2.16	11.09	0.34	0.33	0.00	495	0.03	0.01	500
SideBoom	16,128	142	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.78	1.88	10.07	0.33	0.32	0.00	487	0.03	0.01	492
Trackhoe	16,128	67	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.20	1.01	5.18	0.16	0.15	0.00	231	0.01	0.01	233
Water / Fuel Truck	8,064	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.40	0.98	5.24	0.17	0.17	0.00	254	0.01	0.01	256
Welding Machine	16,128	7	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.04	0.20	0.62	0.04	0.04	0.00	25	0.00	0.00	26
Welding Rig	12,096	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.02	0.12	0.12	0.01	0.01	0.00	5	0.00	0.00	5
X-Ray Truck/Machine	8,064	11	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.03	0.14	0.44	0.03	0.03	0.00	18	0.00	0.00	18

Lancaster County, NE	7.6	27.9	139.7	4.5	4.3	0.1	6387.6	0.4	0.2	6445.8
TOTALS	7.6	27.9	139.7	4.5	4.3	0.05	6,388	0.363	0.165	6,446

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.2
Formaldehyde	0.118	0.9
Acetaldehyde	0.053	0.4
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0

TOTAL HAPS	1.5

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Appendix 9A - Construction Emission Calculations

Table 9A-4 Temporary Compression Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x3)	147	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.01	0.02	0.18	0.00	0.00	0.00	6	0.08	0.00	8
Lancaster County, NE												0.0	0.0	0.2	0.0	0.0	0.0	6.2	0.1	0.0	8.2
TOTALS												0.0	0.0	0.2	0.0	0.0	0.00	6	0.081	0.000	8

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.0
Formaldehyde	0.055	0.0
Benzene	0.002	0.0
1,3-Butadiene	0.001	0.0
Acrolein	0.008	0.0
TOTAL HAPS		0.0

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Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
All Terrain Vehicle (ATV)	6	6	28	5,040	0.25	10	0.256	0.026	0.65	0.06
Backhoe	5	6	28	1,260	20	2	1.840	0.184	1.16	0.12
Dozers	5	6	28	1,260	20	2	1.840	0.184	1.16	0.12
Grader	5	6	28	1,260	20	2	1.840	0.184	1.16	0.12
Pickup Trucks	14	6	28	11,760	2	8	0.653	0.065	3.84	0.38
Pipe Tractor Trailer	4	6	28	1,008	2	8	0.653	0.065	0.33	0.03
Scrapper	4	6	28	1,008	30	2	2.208	0.221	1.11	0.11
SideBoom	8	6	28	2,016	20	2	1.840	0.184	1.85	0.19
Trackhoe	8	6	28	2,016	20	2	1.840	0.184	1.85	0.19
Water / Fuel Truck	4	6	28	3,360	30	8	2.208	0.221	3.71	0.37
Welding Rig	6	6	28	1,512	2	5	0.653	0.065	0.49	0.05

Lancaster County, NE	17.31	1.73
TOTALS	17.31	1.73

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	533	72		0.058	0.0061	1.11	0.12
Topsoil removal by Scrapper for Access Roads, Laydown Yards	6	72		0.058	0.0061	0.01	0.00
Trench excavation and loading to storage piles	575	72		0.037	0.0039	0.77	0.08
Backfilling trench	518	72		0.012	0.0013	0.22	0.02
Topsoil replacement	485	72		0.012	0.0013	0.21	0.02
Wind Erosion Exposed Areas			135	0.38	0.0399	10.09	1.06

Lancaster County, NE	12.4	1.3
TOTALS	12.42	1.30

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 14.64 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 533 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 11 tons per day
Trench excavation and loading: 14.64 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 575 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-7 Pipeline Interconnect Purge Emission Estimates

Operation	Blowdown Type	Blowdown loss per Type (scf)	Density of Natural Gas (lb/scf)	% VOC in Nautral Gas	VOC Emissions (ton)	Methane Emissions (ton)	Methane Emissions (ton CO2e)
Princeton Temporary Compression	One-time Purge	797,000	0.050	8%	1.6	18.3	458
			Lancaster County TOTAL		2	18	458

Note 1: Northern estimates the loss of 0.4 million scf of natural gas as pressure is drawn down in the pipe being connected.

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Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	TOTAL tons
CO	3.1	0.0			3.1
NO_x	13.9	0.0			13.9
PM_{10}	0.5	0.0	2.6	0.7	3.8
$PM_{2.5}$	0.5	0.0	0.3	0.1	0.8
SO_2	0.01	0.00			0.01
VOC	1.0	0.0			1.0
Individual HAP	0.1	0.0			0.1
Combined HAP	0.2	0.0			0.2
Methane	0.0	0.0			0.0
Nitrogen Dioxide	0.0	0.0			0.02
CO_2	667	0			667
CO_{2e}	673	0			673

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Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Backhoe	1	72	20	1440	75	0.21	16
Crane, Wheeled	1	72	20	1440	715	0.47	336
Pickup Trucks	12	72	20	17,280	250	0.59	148
Skid Steer Loader	1	72	20	1,440	75	0.59	44
Welding Rig	2	72	20	2880	10	0.21	2

Assume a 5 month schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Backhoe	1,440	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.01	0.06	0.12	0.01	0.01	0.00	5	0.00	0.00	5
Crane, Wheeled	1,440	336	0.1669	1.3272	4.10	0.132	0.128	0.002	194	0.011	0.005	0.09	0.71	2.19	0.07	0.07	0.00	103	0.01	0.00	104
Pickup Trucks	17,280	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.87	2.10	11.24	0.37	0.36	0.00	544	0.03	0.01	549
Skid Steer Loader	1,440	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.03	0.17	0.33	0.02	0.02	0.00	14	0.00	0.00	14
Welding Rig	2,880	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.00	0.03	0.03	0.00	0.00	0.00	1	0.00	0.00	1

Gage County, NE	1.0	3.1	13.9	0.5	0.5	0.0	666.7	0.0	0.0	672.8
TOTALS	1.0	3.1	13.9	0.5	0.5	0.01	667	0.038	0.017	673

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.1
Acetaldehyde	0.053	0.1
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0

TOTAL HAPS	0.2

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Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Backhoe	1	6	20	180	20	2	1.840	0.184	0.17	0.02
Pickup Trucks	12	6	20	7,200	2	8	0.653	0.065	2.35	0.23
Welding Rig	2	6	20	360	2	5	0.653	0.065	0.12	0.01

Gage County, NE	2.63	0.26
TOTALS	2.63	0.26

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	386	72		0.037	0.0039	0.51	0.05
Backfilling trench	347	72		0.012	0.0013	0.15	0.02
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.01	0.00

Gage County, NE	0.7	0.1
TOTALS	0.68	0.07

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.09 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 76 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.09 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 83 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Temp Compression Emissions tons	TOTAL tons
CO	0.0	0.0
NO_x	0.3	0.3
PM_{10}	0.0	0.0
$PM_{2.5}$	0.0	0.0
SO_2	0.00	0.00
VOC	0.0	0.0
Individual HAP	0.0	0.0
Combined HAP	0.0	0.0
Methane	0.1	0.1
Nitrogen Dioxide	0.0	0.00
CO_2	10	10
CO_{2e}	14	14

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Temporary Compression Emissions - D Line

Equipment	Total Hours Equipment Usage	Maximum Power (hp)	Load Factor	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
					VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x4)	48	300	0.56	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.002	0.007	0.058	0.001	0.001	0.000	2	0.03	0.00	3

Gage County, NE	0.00	0.01	0.06	0.00	0.00	0.00	2.0	0.0	0.0	2.7
TOTALS	0.0	0.0	0.1	0.0	0.0	0.00	2	0.027	0.000	3

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.000
Formaldehyde	0.055	0.001
Benzene	0.002	0.000
1,3-Butadiene	0.001	0.000
Acrolein	0.008	0.000
TOTAL HAPS		0.0

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Table 9A-1 Temporary Compression Emissions - D Line

Equipment	Total Hours Equipment Usage	Maximum Power (hp)	Load Factor	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
					VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x4)	196	300	0.56	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.009	0.029	0.237	0.003	0.003	0.000	8	0.11	0.00	11
Gage County, NE														0.01	0.03	0.24	0.00	0.00	0.00	8.2	0.1	0.0	10.9
TOTALS														0.0	0.0	0.2	0.0	0.0	0.00	8	0.108	0.000	11

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.001
Formaldehyde	0.055	0.004
Benzene	0.002	0.000
1,3-Butadiene	0.001	0.000
Acrolein	0.008	0.001
TOTAL HAPS		0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Temp Flare Emissions tons	TOTAL tons
CO	1.8	0.0			3.8	5.7
NO_x	8.3	0.0			0.8	9.2
PM_{10}	0.3	0.0	1.6	0.7	0.1	2.6
$PM_{2.5}$	0.3	0.0	0.2	0.1	0.1	0.6
SO_2	0.00	0.00			0.01	0.01
VOC	0.6	0.0			8.1	8.7
Individual HAP	0.1	0.0			0.0	0.1
Combined HAP	0.1	0.0			0.0	0.1
Methane	0.0	0.0			1.7	1.7
Nitrogen Dioxide	0.0	0.0			0.0	0.04
CO_2	400	0			1,449	1,849
CO_{2e}	404	0			1,500	1,903

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Backhoe	1	72	12	864	75	0.21	16
Crane, Wheeled	1	72	12	864	715	0.47	336
Pickup Trucks	12	72	12	10,368	250	0.59	148
Skid Steer Loader	1	72	12	864	75	0.59	44
Welding Rig	2	72	12	1728	10	0.21	2

Assume a 3 month schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Backhoe	864	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.01	0.04	0.07	0.00	0.00	0.00	3	0.00	0.00	3
Crane, Wheeled	864	336	0.1669	1.3272	4.10	0.132	0.128	0.002	194	0.011	0.005	0.05	0.42	1.31	0.04	0.04	0.00	62	0.00	0.00	63
Pickup Trucks	10,368	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.52	1.26	6.74	0.22	0.22	0.00	326	0.02	0.01	329
Skid Steer Loader	864	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.02	0.10	0.20	0.01	0.01	0.00	8	0.00	0.00	8
Welding Rig	1,728	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.00	0.02	0.02	0.00	0.00	0.00	1	0.00	0.00	1
Lancaster County, NE												0.6	1.8	8.3	0.3	0.3	0.0	400.0	0.0	0.0	403.7
TOTALS												0.6	1.8	8.3	0.3	0.3	0.00	400	0.023	0.010	404

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.1
Acetaldehyde	0.053	0.0
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0
TOTAL HAPS		0.1

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Backhoe	1	6	12	108	20	2	1.840	0.184	0.10	0.01
Pickup Trucks	12	6	12	4,320	2	8	0.653	0.065	1.41	0.14
Welding Rig	2	6	12	216	2	5	0.653	0.065	0.07	0.01

Lancaster County, NE	1.58	0.16
TOTALS	1.58	0.16

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	386	72		0.037	0.0039	0.51	0.05
Backfilling trench	347	72		0.012	0.0013	0.15	0.02
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.01	0.00

Lancaster County, NE	0.7	0.1
TOTALS	0.68	0.07

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.09 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 76 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.09 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 83 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-7 Temporary Flare Emissions

Equipment	Operating Schedule			Flare Capacity	Gas Purged	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
	Quantity	Hrs/Wk	Weeks Used	MMBtu/Hr	MMBTU	VOC[1]	CO[1]	NOx[1]	PM_{10}[2]	$PM_{2.5}$[2]	SO_2[2]	CO_2[2]	Methane[1]	N_2O[2]	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
FA-E Protego (Hero Flare)	1	28	1	850	828.24	0.66	0.31	0.068	0.007	0.007	0.001	118	0.140	0.002	8.13	3.82	0.84	0.09	0.09	0.01	1449	1.72	0.03	1500
Lancaster County, NE															8.1	3.8	0.8	0.1	0.1	0.0	1448.7	1.7	0.0	1499.7
TOTALS															8.1	3.8	0.8	0.1	0.1	0.01	1,449	1.724	0.027	1,500

[1] EPA AP-42, Fifth Edition, Volume I Chapter 13: Industrial Flares, Section 13.5, Tables 13.5-1 & 13.5-2
[2] EPA AP-42, Fifth Edition, Volume I Chapter 1: External Combustion Sources, Section 1.4, Tables 1.4-2 & 1.4-3

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors[2] (lb/mmbtu)	Emissions (ton/yr)
Formaldehyde	0.0001	0.00
Benzene	0.000	0.00
Hexane	0.002	0.02
Toluene	0.000	0.00
TOTAL HAPS		0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Purge Emissions tons	TOTAL tons
CO	17.7	0.0				17.7
NO_x	88.9	0.1				89.0
PM_{10}	2.8	0.0	11.5	2.2		16.5
$PM_{2.5}$	2.8	0.0	1.1	0.2		4.1
SO_2	0.03	0.00				0.03
VOC	5.0	0.0			0.4	5.4
Individual HAP	0.6	0.0				0.6
Combined HAP	1.0	0.0				1.0
Methane	0.2	0.0			5.2	5.4
Nitrogen Dioxide	0.1	0.0				0.11
CO_2	4,077	4				4,081
CO_{2e}	4,114	5			129	4,248

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Air Compressor	2	72	28	4032	310	0.56	174
All Terrain Vehicle (ATV)	4	72	28	8064	18	1.00	18
Backhoe	3	72	28	6048	75	0.21	16
Cuttings Cleaner System	2	72	28	4032	300	0.59	177
Dozers	3	72	28	6048	410	0.59	242
Dump Truck	8	72	28	16128	325	0.59	192
Generators	4	72	28	8064	430	0.68	292
Grader	3	72	28	6048	140	0.64	90
HDD Rig	1	72	28	2016	600	0.59	354
Mudd Unit	2	72	28	4,032	400	0.21	84
Pickup Trucks	12	72	28	24,192	250	0.59	148
Pipe Tractor Trailer	2	72	28	4,032	400	0.59	236
Scrapper	2	72	28	4,032	488	0.59	288
SideBoom	6	72	28	12,096	240	0.59	142
Trackhoe	6	72	28	12,096	320	0.21	67
Water / Fuel Truck	2	72	28	4032	250	0.59	148
Welding Machine	6	72	28	12096	35	0.21	7
Welding Rig	4	72	28	8064	10	0.21	2
X-Ray Truck/Machine	2	72	28	4032	50	0.21	11

Assume seven month schedule, four weeks per month, 72 hours per week

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				

EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines

Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Air Compressor	4,032	174	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.13	0.65	3.34	0.10	0.10	0.00	149	0.01	0.00	151
All Terrain Vehicle (ATV)	8,064	18	0.4380	2.1610	4.44	0.267	0.259	0.002	194	0.011	0.005	0.07	0.35	0.71	0.04	0.04	0.00	31	0.00	0.00	31
Backhoe	6,048	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.04	0.25	0.49	0.03	0.02	0.00	20	0.00	0.00	21
Cuttings Cleaner System	4,032	177	0.1669	0.8425	4.00	0.132	0.128	0.002	194	0.011	0.005	0.13	0.66	3.15	0.10	0.10	0.00	152	0.01	0.00	154
Dozers	6,048	242	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.27	1.36	6.99	0.21	0.21	0.00	312	0.02	0.01	315
Dump Truck	16,128	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.57	2.87	14.78	0.45	0.44	0.01	660	0.04	0.02	666
Generators	8,064	292	0.3085	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.80	2.19	11.27	0.34	0.33	0.00	503	0.03	0.01	508
Grader	6,048	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.20	0.52	2.45	0.08	0.08	0.00	116	0.01	0.00	117
HDD Rig	2,016	354	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.13	0.66	3.41	0.10	0.10	0.00	152	0.01	0.00	154
Mudd Unit	4,032	84	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.06	0.31	1.62	0.05	0.05	0.00	72	0.00	0.00	73
Pickup Trucks	24,192	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	1.21	2.94	15.73	0.52	0.50	0.01	761	0.04	0.02	768
Pipe Tractor Trailer	4,032	236	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.18	0.88	4.55	0.14	0.13	0.00	203	0.01	0.01	205
Scrapper	4,032	288	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.21	1.08	5.55	0.17	0.16	0.00	248	0.01	0.01	250
SideBoom	12,096	142	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.58	1.41	7.55	0.25	0.24	0.00	365	0.02	0.01	369
Trackhoe	12,096	67	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.15	0.75	3.88	0.12	0.11	0.00	173	0.01	0.00	175
Water / Fuel Truck	4,032	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.20	0.49	2.62	0.09	0.08	0.00	127	0.01	0.00	128
Welding Machine	12,096	7	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.03	0.15	0.46	0.03	0.03	0.00	19	0.00	0.00	19
Welding Rig	8,064	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.01	0.08	0.08	0.01	0.01	0.00	4	0.00	0.00	4
X-Ray Truck/Machine	4,032	11	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.01	0.07	0.22	0.02	0.02	0.00	9	0.00	0.00	9
Dallas County, IA												5.0	17.7	88.9	2.8	2.8	0.0	4077.3	0.2	0.1	4114.5
TOTALS												5.0	17.7	88.9	2.8	2.8	0.03	4,077	0.232	0.105	4,114

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.1
Formaldehyde	0.118	0.6
Acetaldehyde	0.053	0.3
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0

TOTAL HAPS	1.0

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Appendix 9A - Construction Emission Calculations

Table 9A-4 Temporary Compression Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x2)	84	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.00	0.01	0.10	0.00	0.00	0.00	4	0.05	0.00	5

Boone County, IA	0.0	0.0	0.1	0.0	0.0	0.0	3.5	0.0	0.0	4.7
TOTALS	0.0	0.0	0.1	0.0	0.0	0.00	4	0.046	0.000	5

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.0
Formaldehyde	0.055	0.0
Benzene	0.002	0.0
1,3-Butadiene	0.001	0.0
Acrolein	0.008	0.0

TOTAL HAPS	0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
All Terrain Vehicle (ATV)	4	6	28	3,360	0.25	10	0.256	0.026	0.43	0.04
Backhoe	3	6	28	756	20	2	1.840	0.184	0.70	0.07
Dozers	3	6	28	756	20	2	1.840	0.184	0.70	0.07
Grader	3	6	28	756	20	2	1.840	0.184	0.70	0.07
Pickup Trucks	12	6	28	10,080	2	8	0.653	0.065	3.29	0.33
Pipe Tractor Trailer	2	6	28	504	2	8	0.653	0.065	0.16	0.02
Scrapper	2	6	28	504	30	2	2.208	0.221	0.56	0.06
SideBoom	6	6	28	1,512	20	2	1.840	0.184	1.39	0.14
Trackhoe	6	6	28	1,512	20	2	1.840	0.184	1.39	0.14
Water / Fuel Truck	2	6	28	1,680	30	8	2.208	0.221	1.85	0.19
Welding Rig	4	6	28	1,008	2	5	0.653	0.065	0.33	0.03

Dallas County, IA	11.49	1.15
TOTALS	11.49	1.15

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Des Moinse C-Line Branch Line Extension (2027)
Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	90	72		0.058	0.0061	0.19	0.02
Topsoil removal by Scrapper for Access Roads, Laydown Yards	6	72		0.058	0.0061	0.01	0.00
Trench excavation and loading to storage piles	97	72		0.037	0.0039	0.13	0.01
Backfilling trench	88	72		0.012	0.0013	0.04	0.00
Topsoil replacement	87	72		0.012	0.0013	0.04	0.00
Wind Erosion Exposed Areas			24	0.38	0.0399	1.80	0.19

Dallas County, IA	2.2	0.2
TOTALS	2.21	0.23

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.48 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 90 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 11 tons per day
Trench excavation and loading: 2.48 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 97 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	TOTAL tons
CO	1.8	0.0			1.8
NO_x	8.3	0.0			8.3
PM_{10}	0.3	0.0	1.6	0.1	2.0
$PM_{2.5}$	0.3	0.0	0.2	0.0	0.4
SO_2	0.00	0.00			0.00
VOC	0.6	0.0			0.6
Individual HAP	0.1	0.0			0.1
Combined HAP	0.1	0.0			0.1
Methane	0.0	0.0			0.0
Nitrogen Dioxide	0.0	0.0			0.01
CO_2	400	0			400
CO_{2e}	404	0			404

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Backhoe	1	72	12	864	75	0.21	16
Crane, Wheeled	1	72	12	864	715	0.47	336
Pickup Trucks	12	72	12	10,368	250	0.59	148
Skid Steer Loader	1	72	12	864	75	0.59	44
Welding Rig	2	72	12	1728	10	0.21	2

Assume a 3 month schedule, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Backhoe	864	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.01	0.04	0.07	0.00	0.00	0.00	3	0.00	0.00	3
Crane, Wheeled	864	336	0.1669	1.3272	4.10	0.132	0.128	0.002	194	0.011	0.005	0.05	0.42	1.31	0.04	0.04	0.00	62	0.00	0.00	63
Pickup Trucks	10,368	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.52	1.26	6.74	0.22	0.22	0.00	326	0.02	0.01	329
Skid Steer Loader	864	44	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.02	0.10	0.20	0.01	0.01	0.00	8	0.00	0.00	8
Welding Rig	1,728	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.00	0.02	0.02	0.00	0.00	0.00	1	0.00	0.00	1
Dallas County, IA												0.6	1.8	8.3	0.3	0.3	0.0	400.0	0.0	0.0	403.7
TOTALS												0.6	1.8	8.3	0.3	0.3	0.00	400	0.023	0.010	404

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.0
Formaldehyde	0.118	0.1
Acetaldehyde	0.053	0.0
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0
TOTAL HAPS		0.1

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Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
Backhoe	1	6	12	108	20	2	1.840	0.184	0.10	0.01
Pickup Trucks	12	6	12	4,320	2	8	0.653	0.065	1.41	0.14
Welding Rig	2	6	12	216	2	5	0.653	0.065	0.07	0.01

Dallas County, IA	1.58	0.16
TOTALS	1.58	0.16

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	0	72		0.058	0.0061	0.00	0.00
Topsoil removal by Scrapper for Access Roads, Laydown Yards	0	72		0.058	0.0061	0.00	0.00
Trench excavation and loading to storage piles	64	72		0.037	0.0039	0.09	0.01
Backfilling trench	58	72		0.012	0.0013	0.03	0.00
Topsoil replacement	0	72		0.012	0.0013	0.00	0.00
Wind Erosion Exposed Areas			0	0.38	0.0399	0.01	0.00

Dallas County, IA	0.1	0.0
TOTALS	0.12	0.01

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 2.09 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 76 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.09 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 83 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Engine Emissions tons	Temporary Compression tons	Pipeline Unpaved Roads tons	Earthmoving tons	Purge Emissions tons	TOTAL tons
CO	22.8					22.8
NO_x	114.3					114.3
PM_{10}	3.6		14.4	5.9		23.9
$PM_{2.5}$	3.5		1.4	0.6		5.6
SO_2	0.04					0.04
VOC	6.3					6.3
Individual HAP	0.7					0.7
Combined HAP	1.2					1.2
Methane	0.3					0.3
Nitrogen Dioxide	0.1					0.14
CO_2	5,232					5,232
CO_{2e}	5,280					5,280

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Appendix 9A - Construction Emission Calculations

Table 9A-2 Construction Equipment Schedule

Equipment	Pipeline			Total Hours Equipment Usage	Maximum Power (HP)	Load Factor	Loaded Power (HP)
	Quantity	Hrs/Wk	Weeks Used				
Air Compressor	3	72	28	6048	310	0.56	174
All Terrain Vehicle (ATV)	5	72	28	10080	18	1.00	18
Backhoe	4	72	28	8064	75	0.21	16
Cuttings Cleaner System	3	72	28	6048	300	0.59	177
Dozers	4	72	28	8064	410	0.59	242
Dump Truck	9	72	28	18144	325	0.59	192
Generators	5	72	28	10080	430	0.68	292
Grader	4	72	28	8064	140	0.64	90
HDD Rig	2	72	28	4032	600	0.59	354
Mudd Unit	3	72	28	6,048	400	0.21	84
Pickup Trucks	13	72	28	26,208	250	0.59	148
Pipe Tractor Trailer	3	72	28	6,048	400	0.59	236
Scrapper	3	72	28	6,048	488	0.59	288
SideBoom	7	72	28	14,112	240	0.59	142
Trackhoe	7	72	28	14,112	320	0.21	67
Water / Fuel Truck	3	72	28	6048	250	0.59	148
Welding Machine	7	72	28	14112	35	0.21	7
Welding Rig	5	72	28	10080	10	0.21	2
X-Ray Truck/Machine	3	72	28	6048	50	0.21	11

Assume seven month schedule, four weeks per month, 72 hours per week
EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of *EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

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Appendix 9A - Construction Emission Calculations

Table 9A-3 Construction Equipment Engine Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (HP)	Criteria Emission Factors (g/hp-hr)						GHG Emission Factors (g/hp-hr)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Air Compressor	6,048	174	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.19	0.98	5.02	0.15	0.15	0.00	224	0.01	0.01	226
All Terrain Vehicle (ATV)	10,080	18	0.4380	2.1610	4.44	0.267	0.259	0.002	194	0.011	0.005	0.09	0.43	0.89	0.05	0.05	0.00	39	0.00	0.00	39
Backhoe	8,064	16	0.3672	2.3655	4.70	0.240	0.233	0.002	194	0.011	0.005	0.05	0.33	0.66	0.03	0.03	0.00	27	0.00	0.00	27
Cuttings Cleaner System	6,048	177	0.1669	0.8425	4.00	0.132	0.128	0.002	194	0.011	0.005	0.20	0.99	4.72	0.16	0.15	0.00	228	0.01	0.01	230
Dozers	8,064	242	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.36	1.81	9.32	0.28	0.27	0.00	416	0.02	0.01	420
Dump Truck	18,144	192	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.64	3.23	16.63	0.50	0.49	0.01	742	0.04	0.02	749
Generators	10,080	292	0.3085	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	1.00	2.74	14.08	0.43	0.41	0.01	629	0.04	0.02	635
Grader	8,064	90	0.3384	0.8667	4.10	0.132	0.128	0.002	194	0.011	0.005	0.27	0.69	3.27	0.10	0.10	0.00	154	0.01	0.00	156
HDD Rig	4,032	354	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.26	1.33	6.82	0.21	0.20	0.00	305	0.02	0.01	307
Mudd Unit	6,048	84	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.09	0.47	2.43	0.07	0.07	0.00	108	0.01	0.00	109
Pickup Trucks	26,208	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	1.31	3.19	17.04	0.56	0.54	0.01	825	0.05	0.02	832
Pipe Tractor Trailer	6,048	236	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.26	1.33	6.82	0.21	0.20	0.00	305	0.02	0.01	307
Scrapper	6,048	288	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.32	1.62	8.32	0.25	0.25	0.00	372	0.02	0.01	375
SideBoom	14,112	142	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.68	1.65	8.81	0.29	0.28	0.00	426	0.02	0.01	430
Trackhoe	14,112	67	0.1669	0.8425	4.34	0.132	0.128	0.002	194	0.011	0.005	0.17	0.88	4.53	0.14	0.13	0.00	202	0.01	0.01	204
Water / Fuel Truck	6,048	148	0.3085	0.7475	4.00	0.132	0.128	0.002	194	0.011	0.005	0.30	0.74	3.93	0.13	0.13	0.00	190	0.01	0.00	192
Welding Machine	14,112	7	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.03	0.18	0.54	0.04	0.04	0.00	22	0.00	0.00	22
Welding Rig	10,080	2	0.5508	4.1127	4.30	0.500	0.485	0.002	194	0.011	0.005	0.01	0.10	0.10	0.01	0.01	0.00	5	0.00	0.00	5
X-Ray Truck/Machine	6,048	11	0.2789	1.5323	4.73	0.339	0.329	0.002	194	0.011	0.005	0.02	0.11	0.33	0.02	0.02	0.00	14	0.00	0.00	14

Polk County, IA	6.3	22.8	114.3	3.6	3.5	0.0	5232.4	0.3	0.1	5280.1
TOTALS	6.3	22.8	114.3	3.6	3.5	0.04	5,232	0.297	0.135	5,280

EPA 420-P-04-009, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition* , USEPA, April 2004 - Tier 2 Engines
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	Fraction of VOC	Emissions (ton/yr)
Benzene	0.020	0.1
Formaldehyde	0.118	0.7
Acetaldehyde	0.053	0.3
1,3-Butadiene	0.002	0.0
Acrolein	0.003	0.0

TOTAL HAPS	1.2

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Appendix 9A - Construction Emission Calculations

Table 9A-4 Temporary Compression Emissions

Equipment	Total Hours Equipment Usage	Loaded Power (MMBtu)	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
			VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
Temporary Compression (x1)	24	0.8	0.12	0.3860	3.17	0.038	0.038	0.001	110	1.450		0.001	0.004	0.029	0.000	0.000	0.000	1	0.01	0.00	1
Polk County, IA												0.00	0.00	0.03	0.00	0.00	0.00	1.0	0.0	0.0	1.3
TOTALS												0.0	0.0	0.0	0.0	0.0	0.00	1	0.013	0.000	1

EPA AP-42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Table 3.2-1
Load Factors from Appendix A of EPA 420_P-04-005, *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* , USEPA, April 2004

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors (lb/mmbtu)	Emissions (ton/yr)
Acetaldehyde	0.008	0.0
Formaldehyde	0.055	0.0
Benzene	0.002	0.0
1,3-Butadiene	0.001	0.0
Acrolein	0.008	0.0
TOTAL HAPS		0.0

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Appendix 9A - Construction Emission Calculations

Table 9A-5 Fugitive Dust Emissions from Unpaved Roads during Pipeline Installation

Equipment	Pipeline Quantity	Pipeline Days/Wk	Pipeline Weeks Used	VMT	W: Mean Vehicle Weight	S: Mean Vehicle Speed	Emission Factors (lb/VMT) PM_{10}	Emission Factors (lb/VMT) $PM_{2.5}$	Emissions (tons) PM_{10}	Emissions (tons) $PM_{2.5}$
All Terrain Vehicle (ATV)	5	6	28	4,200	0.25	10	0.256	0.026	0.54	0.05
Backhoe	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Dozers	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Grader	4	6	28	1,008	20	2	1.840	0.184	0.93	0.09
Pickup Trucks	13	6	28	10,920	2	8	0.653	0.065	3.56	0.36
Pipe Tractor Trailer	3	6	28	756	2	8	0.653	0.065	0.25	0.02
Scrapper	3	6	28	756	30	2	2.208	0.221	0.83	0.08
SideBoom	7	6	28	1,764	20	2	1.840	0.184	1.62	0.16
Trackhoe	7	6	28	1,764	20	2	1.840	0.184	1.62	0.16
Water / Fuel Truck	3	6	28	2,520	30	8	2.208	0.221	2.78	0.28
Welding Rig	5	6	28	1,260	2	5	0.653	0.065	0.41	0.04

Polk County, IA	14.40	1.44
TOTALS	14.40	1.44

AP 42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2
Surface Silt content based on Table 13.2.2-1 - Construction Sites
Each Vehicle is assumed to travel 1.5 mile per day on site, except ATV, Water Truck, and Pickup, which are assumed to travel five miles per day.

Constants	PM	PM_{10}	$PM_{2.5}$	
k	4.9	1.5	0.15	lb/VMT
a	0.7	0.9	0.9	
b	0.45	0.45	0.45	

P	105	days with 0.01 inches rain (Figure 13.2.2-1)
s	8.5	surface material silt content (%)

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Appendix 9A - Construction Emission Calculations

Table 9A-6 Fugitive Dust Emissions from Earthmoving Activities

Construction Activity	Daily Material Handling Rate (ton/day)	Construction Days	Average Exposed Area (acres)	Emission Factors (lb/ton)		Emissions (tons)	
				PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Topsoil removal by Scrapper for Pipeline	248	72		0.058	0.0061	0.52	0.05
Topsoil removal by Scrapper for Access Roads, Laydown Yards	6	72		0.058	0.0061	0.01	0.00
Trench excavation and loading to storage piles	268	72		0.037	0.0039	0.36	0.04
Backfilling trench	241	72		0.012	0.0013	0.10	0.01
Topsoil replacement	229	72		0.012	0.0013	0.10	0.01
Wind Erosion Exposed Areas			64	0.38	0.0399	4.77	0.50

Polk County, IA	5.9	0.6
TOTALS	5.86	0.62

Assumptions:

Construction schedule of 7 month, 4 weeks per month, six days per week.
Topsoil removal (pipeline): 6.83 miles, 25 feet wide, 1 foot deep, 1.25 tons per cubic yard = 248 tons per day
Topsoil removal (roads/laydown): 1 acres, 0.5 foot deep, 1.25 tons per cubic yard = 6 tons per day
Trench excavation and loading: 2.48 miles, 2 yards wide, 1.5 yards deep, 1.25 tons per yard = 268 tons per day
Topsoil removal by Scrapper emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scrapper
Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump
Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement
As worst case, PM_{10} is set equal to Total Particulate Matter. $PM_{2.5}$ is set to 0.105 times PM_{10} per Table 11.9-1
Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)
Average Exposed Area - Total disturbed area during construction is assumed as 166 acres, assume 25 percent is exposed at any time.

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Appendix 9A - Construction Emission Calculations

Table 9A-1 Construction Emission Estimates - Total Project

Pollutant	Temp Flare Emissions tons	TOTAL tons
CO	2.1	2.1
NO_x	0.5	0.5
PM_{10}	0.1	0.1
$PM_{2.5}$	0.1	0.1
SO_2	0.00	0.00
VOC	4.6	4.6
Individual HAP	0.0	0.0
Combined HAP	0.0	0.0
Methane	1.0	1.0
Nitrogen Dioxide	0.0	0.01
CO_2	814	814
CO_{2e}	842	842

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Appendix 9A - Construction Emission Calculations

Table 9A-8 Temporary Flare Emissions

Equipment	Operating Schedule			Flare Capacity	Gas Purged	Criteria Emission Factors (lb/mmbtu)						GHG Emission Factors (lb/mmbtu)			Criteria Emissions (tons)						GHG Emissions (tons)			
	Quantity	Hrs/Wk	Weeks Used	MMBtu/Hr	MMBTU	VOC[1]	CO[1]	NOx[1]	PM_{10}[2]	$PM_{2.5}$[2]	SO_2[2]	CO_2[2]	Methane[1]	N_2O[2]	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2	Methane	N_2O	CO_{2e}
FA-E Protego (Hero Flare)	1	16	1	850	232.56	0.66	0.31	0.068	0.007	0.007	0.001	118	0.140	0.002	4.56	2.14	0.47	0.05	0.05	0.00	814	0.97	0.01	842

Boone County, IA	4.6	2.1	0.5	0.1	0.1	0.0	813.7	1.0	0.0	842.3
TOTALS	4.6	2.1	0.5	0.1	0.1	0.00	814	0.968	0.015	842

[1] EPA AP-42, Fifth Edition, Volume I Chapter 13: Industrial Flares, Section 13.5, Tables 13.5-1 & 13.5-2
[2] EPA AP-42, Fifth Edition, Volume I Chapter 1: External Combustion Sources, Section 1.4, Tables 1.4-2 & 1.4-3

HAP Pollutant Emissions - Construction Equipment

Air Toxic	HAP Emission Factors[2] (lb/mmbtu)	Emissions (ton/yr)
Formaldehyde	0.0001	0.00
Benzene	0.000	0.00
Hexane	0.002	0.01
Toluene	0.000	0.00

TOTAL HAPS	0.0

Appendix 9B
Detailed Calculation Sheets for Operational Emissions

Northern Natural Gas Company - Clarion Compressor Station
Proposed Facility Total PTE

Hourly Emissions

Source	EP #	EU #	Capacity	Hourly Emissions (lb/hr)								
				NO_x	CO	CO_2e	PM10	PM2.5	VOC	SO_2	CH_2O	Total HAP
Compressor Turbine	EP1	EU1	20,843 hp 0 Deg F	9.05	9.19	19,560	1.10	1.10	1.05	9.54	0.12	0.17
Emergency Generator	EP2	EU2	908 HP	4.00	8.01	850.59	0.35	0.35	2.00	4.27E-03	0.40	0.58
Equipment Leaks	--	EU3				87.02			0.02			
Blowdowns	--	EU4				194.08			0.05			
Fuel Gas Heater	--	IA	1.24 MMBtu/hr	0.12	0.10	145.20	9.24E-03	9.24E-03	6.69E-03	7.29E-04	9.12E-05	2.29E-03
Space Heaters	--	IA	0.42 MMBtu/hr	0.04	0.02	49.18	3.13E-03	3.13E-03	2.26E-03	2.47E-04	3.09E-05	7.75E-04
Facility PTE				**13.21**	**17.32**	**20,886**	**1.47**	**1.47**	**3.14**	**9.54**	**0.52**	**0.75**
State Modeling Thresholds				9.13	22.80	NA	3.42	2.28	NA	9.13	NA	NA

Annual Emissions

Source	EP #	EU #	Capacity	Annual Emissions (tpy)								
				NO_x	CO	CO_2e	PM10	PM2.5	VOC	SO_2	CH_2O	Total HAP
Compressor Turbine	EP1	EU1	20,843 hp 0 Deg F	46.41	94.13	85,674	4.83	4.83	5.60	0.52	0.52	0.75
Emergency Generator	EP2	EU2	908 HP	1.00	2.00	212.65	0.09	0.09	0.50	1.07E-03	0.10	0.14
Equipment Leaks	--	EU3				381.15			0.11			
Blowdowns	--	EU4				850.08			0.24			
Fuel Gas Heater	--	IA	1.24 MMBtu/hr	0.53	0.45	635.98	0.04	0.04	0.03	3.19E-03	3.99E-04	0.01
Space Heaters	--	IA	0.42 MMBtu/hr	0.17	0.07	215.41	0.01	0.01	9.92E-03	0.001	1.35E-04	0.003
Facility PTE				**48.11**	**96.65**	**87,970**	**4.97**	**4.97**	**6.49**	**0.53**	**0.62**	**0.91**
PSD Major Source Threshold				250	250	n/a	250	250	250	250	n/a	n/a
Title V Threshold				100	100	100,000	100	100	100	100	10	25
Applicability				Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Area Source	Area Source

Northern Natural Gas Company - Clarion Compressor Station
Compressor Turbine - Titan 130-20502S

EP #:	EP1
EU #:	EU1
Description:	Compressor Turbine Solar Titan 130-20502S

Horsepower	20,843	hp (0 °F)
Brake Specific Fuel Consumption	7449	Btu/Bhp-hr (LHV, 0 °F)
Total Heat Input	150.49	MMBtu/hr (LHV, 0 °F)
	167.04	MMBtu/hr (HHV, 0 °F)
Operating Hours	8760	hr/yr
Natural Gas Heat Content	1020	Btu/scf
Fuel Consumption	1434.61	MMscf/yr (based on 0 °F)
	163,768.5	scf/hr (based on 0 °F)
Quantity	1	

Pollutant	Emission Factor[1,2,3]			Emission Rate		Emission Factor Reference
	ppmvd@15%O_2	lb/MMBtu		lb/hr[6]	ton/yr[7]	
NO_x	15.00	0.060	LHV	9.05	46.41	Vendor Data
CO	25.00	0.061	LHV	9.19	94.13	Vendor Data
CO2[4]		117.0	HHV	19,540	85,587	40 CFR 98 Subpart C
CH4[4]		0.002	HHV	0.3683	1.6130	40 CFR 98 Subpart C
N2O[4]		0.0002	HHV	0.0368	0.1613	40 CFR 98 Subpart C
CO_2e[4]		117.1	HHV	19,560	85,674	40 CFR 98 Subpart C
PM		0.0066	HHV	1.10	4.83	AP-42 Table 3.1-2a (4/00)
PM_{10}		0.0066	HHV	1.10	4.83	AP-42 Table 3.1-2a (4/00)
$PM_{2.5}$		0.0066	HHV	1.10	4.83	AP-42 Table 3.1-2a (4/00)
VOC	5.00	0.007	LHV	1.05	5.60	Vendor Data (20% of UHC)
SO_2 (Maximum Hourly)		0.0571	HHV	9.54		20 grains S / 100 scf
SO_2 (Average Annual)		0.000714	HHV		0.52	0.25 grains S / 100 scf
Formaldehyde		7.10E-04	HHV	0.12	0.52	AP-42 Table 3.1-3 (4/00)
1,3-Butadiene		4.30E-07	HHV	7.18E-05	3.15E-04	AP-42 Table 3.1-3 (4/00)
Acetaldehyde		4.00E-05	HHV	6.68E-03	2.93E-02	AP-42 Table 3.1-3 (4/00)
Acrolein		6.40E-06	HHV	1.07E-03	4.68E-03	AP-42 Table 3.1-3 (4/00)
Benzene		1.20E-05	HHV	2.00E-03	8.78E-03	AP-42 Table 3.1-3 (4/00)
Ethylbenzene		3.20E-05	HHV	5.35E-03	2.34E-02	AP-42 Table 3.1-3 (4/00)
Naphthalene		1.30E-06	HHV	2.17E-04	9.51E-04	AP-42 Table 3.1-3 (4/00)
PAH		2.20E-06	HHV	3.67E-04	1.61E-03	AP-42 Table 3.1-3 (4/00)
Propylene Oxide		2.90E-05	HHV	4.84E-03	2.12E-02	AP-42 Table 3.1-3 (4/00)
Toluene		1.30E-04	HHV	2.17E-02	9.51E-02	AP-42 Table 3.1-3 (4/00)
Xylene		6.40E-05	HHV	1.07E-02	4.68E-02	AP-42 Table 3.1-3 (4/00)
Total		1.03E-03		1.72E-01	0.75	

Notes:

1. Emission factors for NOX, CO, and VOC obtained from manufacturer data. Vendor Data (20% of UHC). VOC based on 20% of vendor data for unburned hydrocarbon.
2. Emission factors for PM and SO2 based on AP-42 (AP-42 Section 3.1 - Stationary Gas Turbines, Table 3.1-2a). PM = PM10 = PM2.5 is assumed
3. Emission factors for HAPs based on AP-42 factors (AP-42 Section 3.1 - Stationary Gas Turbines, Table 3.1-3).
4. Emission factors based on 40 CFR 98 Subpart C. Updated January 2025.
5. HHV heat input based on HHV=1.11*LHV

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7. Annual emission rate based on combination of potential operating modes as provided on following page for NOx, CO, and VOC. The operating modes are 100 hours at low load (low load hours are based on <50% load), 500 hours at low temp (< 30 °F) and 100 startups and shutdowns per year. The remainder of the hours per year are based on emissions at normal load (60 °F). Normal operation is considered to be 50%-100% load. All other pollutants are based on horsepower and brake specific fuel consumption at 30 °F.

Northern Natural Gas Company - Clarion Compressor Station

Emission Rates per Operating Mode

Operating Mode	Units	NO_x	CO	VOC
Normal Load @ 0°F[1]	lb/hr	9.05	9.19	1.05
Low-Temp @ -20 F	lb/hr	26.2	38.0	2.16
Low-Load (<50%)[3]	lb/hr	20.97	850.77	9.72
Startup/ Shutdown[4]	lb/event	3.00	146.00	16.00

1. Based on data from Solar Centaur Compressor Set Predicted Emission Performance data sheet and the following concentrations:

25 ppm NOx; 50 ppm CO; 25 ppm VOC

2. Based on data from Solar PIL 167 Revision 8.1 (5-16-2022), Table 2 for Titan 130 20502S.
3. For the purpose of calculating potential annual emissions, non-startup/shutdown operation at <50% load is based on emissions data provided by Solar for 40% load.
4. Based on data from Solar PIL 167 Revision 6 (12-1-2016), Table 2 for Titan 130 20502S.

Potential Annual Emissions

Operating Mode	Operating Time		NO_x	CO	VOC
	Cycles	hr/yr	ton/yr	ton/yr	ton/yr
Normal Load @ 0 °F		7933	35.90	36.45	4.17
Low-Temp @ -20 F		720	9.43	13.68	0.78
Low-Load (<40%)		100	1.05	42.54	0.49
Startup/ Shutdown	20	7	0.03	1.46	0.16
Total		8,760	46.41	94.13	5.60

Northern Natural Gas Company - Clarion Compressor Station
Natural-Gas Fired Standby Electric Generator
Generac SG/MG750

EP # EP2
EU # EU2

Rated Mechanical Output: (ISO)

Fuel Consumption:	8,000	Btu/hp-hr	
Fuel Type:	Natural Gas	908	Horsepower
Operating Hours (Limit)	500	hours	

Pollutant	Emission Factor (lb/MMBtu)	Emission Factor (g/hp-hr)	Uncontrolled Emissions (lb/hr)	Uncontrolled Emissions (ton/yr)	Limited and Controlled Emissions (lb/hr)	Limited and Controlled Emissions (ton/yr)
PM^{1}	4.83E-02	--	0.35	1.54	0.35	0.09
$PM_{10}{}^{1}$	4.83E-02	--	0.35	1.54	0.35	0.09
$PM_{2.5}{}^{1}$	4.83E-02	--	0.35	1.54	0.35	0.09
$SO_2{}^{1}$	5.88E-04	--	4.27E-03	1.87E-02	4.27E-03	1.07E-03
$CO_2{}^{3}$	116.98	--	849.72	3721.78	849.72	212.43
$CH_4{}^{3}$	2.20E-03	--	0.02	7.01E-02	0.02	4.00E-03
N_2O^{3}	2.20E-04	--	1.60E-03	7.01E-03	1.60E-03	4.00E-04
CO_2e^{3}	117.10	--	850.59	3725.60	850.59	212.65
$NO_x{}^{2}$		2.00	4.00	17.54	4.00	1.00
VOC^{2}		1.00	2.00	8.77	2.00	0.50
CO^{2}		4.00	8.01	35.07	8.01	2.00

[1] Emission factors based on AP-42, Fifth Edition, Section 3.2 "Natural Gas-Fired Reciprocating Engines", Table 3.2-1 Uncontrolled Emission Factors for 2-Stroke Lean-Burn Engines, 10/24

[2] Emission factors based on 40 CFR Part 60 Subpart JJJJ limits. The vendor guarantee confirms compliance with the NSPS JJJJ limits.

[3] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Uncontrolled Emissions (lb/hr)	Uncontrolled Emissions (ton/yr)	Limited and Controlled Emissions (lb/hr)	Limited and Controlled Emissions (ton/yr)
1,1,2,2-Tetrachloroethane	6.63E-05	4.82E-04	2.11E-03	4.82E-04	1.20E-04
1,1,2-Trichloroethane	5.27E-05	3.83E-04	1.68E-03	3.83E-04	9.57E-05
1,3-Butadiene	8.20E-04	5.96E-03	2.61E-02	5.96E-03	1.49E-03
1,3-Dichloropropene	4.38E-05	3.18E-04	1.39E-03	3.18E-04	7.95E-05
2,2,4-Trimethylpentane	8.46E-04	6.15E-03	2.69E-02	6.15E-03	1.54E-03
Acenaphthene	1.33E-06	9.66E-06	4.23E-05	9.66E-06	2.42E-06
Acenaphthylene	3.17E-06	2.30E-05	1.01E-04	2.30E-05	5.76E-06
Acetaldehyde	7.76E-03	5.64E-02	2.47E-01	5.64E-02	1.41E-02
Acrolein	7.78E-03	5.65E-02	2.48E-01	5.65E-02	1.41E-02
Benzene	1.94E-03	1.41E-02	6.17E-02	1.41E-02	3.52E-03
Biphenyl	3.95E-06	2.87E-05	1.26E-04	2.87E-05	7.17E-06
Carbon Tetrachloride	6.07E-05	4.41E-04	1.93E-03	4.41E-04	1.10E-04
Chlorobenzene	4.44E-05	3.23E-04	1.41E-03	3.23E-04	8.06E-05
Chloroform	4.71E-05	3.42E-04	1.50E-03	3.42E-04	8.55E-05
Ethylbenzene	1.08E-04	7.85E-04	3.44E-03	7.85E-04	1.96E-04
Ethylene Dibromide	7.34E-05	5.33E-04	2.34E-03	5.33E-04	1.33E-04
Formaldehyde	5.52E-02	4.01E-01	1.76E+00	4.01E-01	1.00E-01
Methanol	2.48E-03	1.80E-02	7.89E-02	1.80E-02	4.50E-03
Methylene Chloride	1.47E-04	1.07E-03	4.68E-03	1.07E-03	2.67E-04
n-Hexane	4.45E-04	3.23E-03	1.42E-02	3.23E-03	8.08E-04
Naphthalene	9.63E-05	7.00E-04	3.06E-03	7.00E-04	1.75E-04
Total PAH (w/naphthalene)	1.34E-04	9.73E-04	4.26E-03	9.73E-04	2.43E-04
Phenol	4.21E-05	3.06E-04	1.34E-03	3.06E-04	7.65E-05
Styrene	5.48E-05	3.98E-04	1.74E-03	3.98E-04	9.95E-05
Toluene	9.63E-04	7.00E-03	3.06E-02	7.00E-03	1.75E-03
Vinyl Chloride	2.47E-05	1.79E-04	7.86E-04	1.79E-04	4.49E-05
Xylene	2.68E-04	1.95E-03	8.53E-03	1.95E-03	4.87E-04
Total HAP		**5.77E-01**	**2.53E+00**	**5.77E-01**	**1.44E-01**

[1] Emission factors based on AP-42, Fifth Edition, Section 3.2 "Natural Gas-Fired Reciprocating Engines," Table 3.2-1, 10/24

Methodology
Potential to Emit (lb/hr) = Emission Factor (lb/MMBtu) x 1 MMBtu/1,000,000 Btu x Fuel Use (Btu/hp-hr) x Horsepower (hp)
Potential to Emit (tons/year) = Potential to Emit (lb/hr) x 8,760 hr/yr x 1 ton/2,000 lb

Northern Natural Gas Company - Clarion Compressor Station
Natural Gas Fired Fuel Gas Heater

Firing Capacity: 1.240 MMBTU/hr 0.620 MMBtu/hr per tube, 2 tubes
Heat Value: 1,020 BTU/cf

Pollutant	Emission Factor[1,2] (lb/MMBtu)	Emission Rate (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
PM	7.45E-03	9.24E-03	0.04
PM_{10}	7.45E-03	9.24E-03	0.04
$PM_{2.5}$	7.45E-03	9.24E-03	0.04
SO_2	5.88E-04	7.29E-04	3.19E-03
CO_2[2]	116.98	145.05	635.33
CH_4[2]	2.20E-03	2.73E-03	0.01
N_2O[2]	2.20E-04	2.73E-04	1.20E-03
CO_2e[2]	117.10	145.20	635.98
NO_x	0.098	0.12	0.53
VOC	5.39E-03	6.69E-03	0.03
CO	0.082	0.10	0.45

[1]Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

[2] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Maximum Uncontrolled Emissions (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
2-Methylnaphthalene	2.35E-08	2.92E-08	1.28E-07
3-Methylchloranthrene	1.76E-09	2.19E-09	9.58E-09
7,12-Dibethylbenz(a)anthracene	1.57E-08	1.95E-08	8.52E-08
Acenaphthene	1.76E-09	2.19E-09	9.58E-09
Acenaphthylene	1.76E-09	2.19E-09	9.58E-09
Anthracene	2.35E-09	2.92E-09	1.28E-08
Benz(a)anthracene	1.76E-09	2.19E-09	9.58E-09
Benzene	2.06E-06	2.55E-06	1.12E-05
Benzo(a)pyrene	1.18E-09	1.46E-09	6.39E-09
Benzo(b)fluoranthene	1.76E-09	2.19E-09	9.58E-09
Benzo(b,h,i)perylene	1.18E-09	1.46E-09	6.39E-09
Benzo(k)fluoranthene	1.76E-09	2.19E-09	9.58E-09
Chrysene	1.76E-09	2.19E-09	9.58E-09
Dibenzo(a,h)anthracene	1.18E-09	1.46E-09	6.39E-09
Dichlorobenzene	1.18E-06	1.46E-06	6.39E-06
Fluoranthene	2.94E-09	3.65E-09	1.60E-08
Fluorene	2.75E-09	3.40E-09	1.49E-08
Formaldehyde	7.35E-05	9.12E-05	3.99E-04
Hexane	1.76E-03	2.19E-03	9.58E-03
Indeno(1,2,3-cd)pyrene	1.76E-09	2.19E-09	9.58E-09
Naphthalene	5.98E-07	7.42E-07	3.25E-06
Phenanthrene	1.67E-08	2.07E-08	9.05E-08
Pyrene	4.90E-09	6.08E-09	2.66E-08
Toluene	3.33E-06	4.13E-06	1.81E-05
Total HAP		2.29E-03	1.00E-02

Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

Northern Natural Gas Company - Clarion Compressor Station
Natural Gas Fired Space Heaters

Heating Characteristics of Space Heaters

	Unit Rating (MMBtu/hr)	Location
Heater 1	0.060	Compressor Building
Heater 2	0.060	
Heater 3	0.060	
Heater 4	0.060	
Heater 5	0.060	
Heater 6	0.060	Auxiliary Building
Heater 7	0.060	
Total	**0.420**	

Heat Value: 1,020 BTU/cf

Existing Space Heaters

Pollutant	Emission Factor (lb/MMBtu)	Emission Rate (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
PM	7.45E-03	3.13E-03	0.014
PM_{10}	7.45E-03	3.13E-03	0.014
$PM_{2.5}$	7.45E-03	3.13E-03	0.014
SO_2	5.88E-04	2.47E-04	0.001
CO_2[2]	116.98	4.91E+01	215.19
CH_4[2]	2.20E-03	9.26E-04	4.06E-03
N_2O[2]	2.20E-04	9.26E-05	4.06E-04
CO_2e[2]	117.10	4.92E+01	215.41
NO_x	9.22E-02	3.87E-02	0.170
VOC	5.39E-03	2.26E-03	0.010
CO	3.92E-02	1.65E-02	0.072

[1]Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

[2] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Maximum Uncontrolled Emissions (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
2-Methylnaphthalene	2.35E-08	9.88E-09	4.33E-08
3-Methylchloranthrene	1.76E-09	7.41E-10	3.25E-09
7,12-Dibethylbenz(a)anthracene	1.57E-08	6.59E-09	2.89E-08
Acenaphthene	1.76E-09	7.41E-10	3.25E-09
Acenaphthylene	1.76E-09	7.41E-10	3.25E-09
Anthracene	2.35E-09	9.88E-10	4.33E-09
Benz(a)anthracene	1.76E-09	7.41E-10	3.25E-09
Benzene	2.06E-06	8.65E-07	3.79E-06
Benzo(a)pyrene	1.18E-09	4.94E-10	2.16E-09
Benzo(b)fluoranthene	1.76E-09	7.41E-10	3.25E-09
Benzo(b,h,i)perylene	1.18E-09	4.94E-10	2.16E-09
Benzo(k)fluoranthene	1.76E-09	7.41E-10	3.25E-09
Chrysene	1.76E-09	7.41E-10	3.25E-09
Dibenzo(a,h)anthracene	1.18E-09	4.94E-10	2.16E-09
Dichlorobenzene	1.18E-06	4.94E-07	2.16E-06
Fluoranthene	2.94E-09	1.24E-09	5.41E-09
Fluorene	2.75E-09	1.15E-09	5.05E-09
Formaldehyde	7.35E-05	3.09E-05	1.35E-04
Hexane	1.76E-03	7.41E-04	3.25E-03
Indeno(1,2,3-cd)pyrene	1.76E-09	7.41E-10	3.25E-09
Naphthalene	5.98E-07	2.51E-07	1.10E-06
Phenanthrene	1.67E-08	7.00E-09	3.07E-08
Pyrene	4.90E-09	2.06E-09	9.02E-09
Toluene	3.33E-06	1.40E-06	6.13E-06
Total HAP		7.75E-04	3.39E-03

Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

Note: Space heaters are defined as those not connected to piping or ducting to distribute heat.

Northern Natural Gas Company - Clarion Compressor Station
Fugitive Emissions from Leaks

Component Type	EU#	Type of Service [1]	Number of Components [1]	Emission Factors (lb/hr-component) [2]	Percent VOC [3]	Percent CH4 [3]	Percent CO2 [3]	Potential VOC Emission Rates [4]		Potential CH4 Emission Rates [4]		Potential CO2 Emission Rates [4]		Potential CO2e Emission Rates [4]	
								(lb/hr)	(ton/yr)	(lb/hr)	(T/yr)	(lb/hr)	(T/yr)	(lb/hr)	(T/yr)
Valves	EU3	Gas/Vapor	253	0.00992	0.68%	86.78%	0.86%	0.02	0.08	2.18	9.54	0.02	0.09	61.01	267.21
Flanges	EU3	Gas/Vapor	94	0.00086	0.68%	86.78%	0.86%	0.001	0.002	0.07	0.31	0.001	0.003	1.96	8.60
Compressor Seals	EU3	Gas/Vapor	31	0.01940	0.68%	86.78%	0.86%	0.004	0.02	0.52	2.29	0.01	0.02	14.62	64.03
Relief Valves	EU3	Gas/Vapor	20	0.01940	0.68%	86.78%	0.86%	0.003	0.01	0.34	1.47	0.003	0.01	9.43	41.31
Totals:		---	**398**	**3.580**	---	---	---	**0.0246**	**0.110**	**3.110**	**13.610**	**0.030**	**0.120**	**87.020**	**381.150**

Conversion kg to lb: 2.204623

Notes:

1. Number of each component and type of service estimated based on preliminary design documents.
2. Emission factors based on Table 2-4 'Oil and Gas Production Operations Average Emission Factors' from 'Protocol for Equipment Leak Emission Estimates' (EPA-453/R-95-017 - November 1995).
3. Percent VOC for Gas/Vapor service based on gas analysis from representative facility (refer to Attachment 4, Table 2).
4. Emission rates based on 8,760 hours of operation per year.

			Total Fugitive VOC/HAP Uncontrolled Emissions	
Pollutant		**Wt% [1]**	**(lb/hr)**	**(T/yr)**
Benzene		0.00%	0.0000	0.0000
Toluene		0.00%	0.0000	0.0000
Ethylbenzene		0.00%	0.0000	0.0000
Xylenes		0.00%	0.0000	0.0000
n-Hexane		0.00%	0.0000	0.0000
Total HAPs		**0.00%**	**0.0000**	**0.0000**
Total VOCs		**0.685%**	**0.02**	**0.11**

**Based on Gas Analyses, which shows other hexanes to be 0%.

Fugitive Emissions from Venting

Facility	Volume	Emissions						
		CH4		CO2		CO2e	VOC	HAP
	(scf/yr)	scf/year	ton/year	scf/year	ton/year	ton/year	ton/year	ton/year
Compressor Station Blowdown	606,500	526,297	11.14	5,191	0.30	312.19	0.09	0.00
Compressor Unit Blowdown	1,045,000	906,809	19.19	8,944	0.52	537.90	0.15	0.00
Total		--	**30.33**	--	**0.82**	**850.08**	**0.24**	**0.00**

Gas Composition:	86.78%	CH_4	
	0.86%	$CO_{2\ [1]}$	
Density from 40 CFR 98.233(v)	0.0192	kg/scf	CH_4
	0.0526	kg/scf	CO_2
Conversion Factor	2.20462	lb/kg	
	2000	lb/ton	
GWP per 40 CFR 98 Subpart A	28	lb CO_2e/lb CH_4	
Ratio of VOC to CH4	0.008	(by mass)[1]	
Ratio of HAP to CH4	0.000	(by mass)[1]	

[1] Data From GC3800

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line tie-over regulator

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.5
CO_2		
CO_{2e}	2.3	13.3

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line tie-over regulator

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}								9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line tie-over regulator

36 in
40 ft

VOC and GHG Pollutant Operating Emissions from Above-grade Process Piping: Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Pig Receiver Assembly	Volume (cf) (V)	Pressure (psi) (P)	Events per year (f)					
(1) 20" diameter Pig receiver/launcher	43.3	1000	5	1.05%		0.01		0.98
Total					0.00	0.01	0.00	0.98
CO_{2e}								24

Total Project Methane emissions from pigging events (tons CH_4)	1
Annualized Methane emissions (tons CH_4/year)	0.1
Total Project CO_{2e} emissions from pigging events (tons CO_{2e})	24
Annualized CO_{2e} emissions (tons CO_{2e}/year)	3.5

Notes:

1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-95-017 dated November 1995

2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

3) Emissions estimated = P * V/14.7 * n * f, where P = pressure, V = volume (cf) of pig loader, n = % natural gas, f = number of piggings [the lines are pigged 5 times in a one week period, once every 7 years]

4) Assume density of natural gas at standard conditions = 0.0447 lb/cf

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line loop receiver facility

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.5
CO_2		
CO_{2e}	2.3	13.3

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line loop receiver facility

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}								9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Omaha 3rd branch line loop receiver facility

36 in
40 ft

VOC and GHG Pollutant Operating Emissions from Above-grade Process Piping: Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Pig Receiver Assembly	Volume (cf) (V)	Pressure (psi) (P)	Events per year (f)					
(1) 20" diameter Pig receiver/launcher	43.3	1000	5	1.05%		0.01		0.98
Total					0.00	0.01	0.00	0.98
CO_{2e}								24

Total Project Methane emissions from pigging events (tons CH_4)	1
Annualized Methane emissions (tons CH_4/year)	0.1
Total Project CO_{2e} emissions from pigging events (tons CO_{2e})	24
Annualized CO_{2e} emissions (tons CO_{2e}/year)	3.5

Notes:

1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-95-017 dated November 1995

2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

3) Emissions estimated = P * V/14.7 * n * f, where P = pressure, V = volume (cf) of pig loader, n = % natural gas, f = number of piggings [the lines are pigged 5 times in a one week period, once every 7 years]

4) Assume density of natural gas at standard conditions = 0.0447 lb/cf

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
NPPD Princeton Road power station launcher facility

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.02
Individual HAP		
Combined HAP		
Methane	0.00	0.3
CO_2		
CO_{2e}	0.0	7.9

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
NPPD Princeton Road power station launcher facility

36 in
40 ft

VOC and GHG Pollutant Operating Emissions from Above-grade Process Piping: Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Pig Receiver Assembly	Volume (cf) (V)	Pressure (psi) (P)	Events per year (f)					
(1) 30" diameter Pig receiver/launcher	98.1	1000	5	1.05%		0.02		2.21
Total					0.00	0.02	0.00	2.21
CO_{2e}								55

Total Project Methane emissions from pigging events (tons CH_4)	2
Annualized Methane emissions (tons CH_4/year)	0.3
Total Project CO_{2e} emissions from pigging events (tons CO_{2e})	55
Annualized CO_{2e} emissions (tons CO_{2e}/year)	7.9

Notes:

1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-95-017 dated November 1995

2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

3) Emissions estimated = P * V/14.7 * n * f, where P = pressure, V = volume (cf) of pig loader, n = % natural gas, f = number of piggings [the lines are pigged 5 times in a one week period, once every 7 years]

4) Assume density of natural gas at standard conditions = 0.0447 lb/cf

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
NPPD Princeton Road power station meter station

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.7
CO_2		
CO_{2e}	2.3	17.8

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
NPPD Princeton Road power station meter station

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}							2.3	9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
NPPD Princeton Road power station meter station

36 in
40 ft

VOC and GHG Pollutant Operating Emissions from Above-grade Process Piping: Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Pig Receiver Assembly	Volume (cf) (V)	Pressure (psi) (P)	Events per year (f)					
(1) 30" diameter Pig receiver/launcher	98.1	1000	5	1.05%		0.02		2.21
Total					0.00	0.02	0.00	2.21
CO_{2e}								55

Total Project Methane emissions from pigging events (tons CH_4)	2
Annualized Methane emissions (tons CH_4/year)	0.3
Total Project CO_{2e} emissions from pigging events (tons CO_{2e})	55
Annualized CO_{2e} emissions (tons CO_{2e}/year)	7.9

Notes:

1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-95-017 dated November 1995

2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

3) Emissions estimated = P * V/14.7 * n * f, where P = pressure, V = volume (cf) of pig loader, n = % natural gas, f = number of piggings [the lines are pigged 5 times in a one week period, once every 7 years]

4) Assume density of natural gas at standard conditions = 0.0447 lb/cf

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Proposed Des Moines north loop receiver

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.5
CO_2		
CO_{2e}	2.3	13.3

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Proposed Des Moines north loop receiver

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}							2.3	9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Proposed Des Moines north loop receiver

36 in
40 ft

VOC and GHG Pollutant Operating Emissions from Above-grade Process Piping: Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Pig Receiver Assembly	Volume (cf) (V)	Pressure (psi) (P)	Events per year (f)					
(1) 20" diameter Pig receiver/launcher	43.3	1000	5	1.05%		0.01		0.98
Total					0.00	0.01	0.00	0.98
CO_{2e}								24

Total Project Methane emissions from pigging events (tons CH_4)	1
Annualized Methane emissions (tons CH_4/year)	0.1
Total Project CO_{2e} emissions from pigging events (tons CO_{2e})	24
Annualized CO_{2e} emissions (tons CO_{2e}/year)	3.5

Notes:

1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-95-017 dated November 1995

2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

3) Emissions estimated = P * V/14.7 * n * f, where P = pressure, V = volume (cf) of pig loader, n = % natural gas, f = number of piggings [the lines are pigged 5 times in a one week period, once every 7 years]

4) Assume density of natural gas at standard conditions = 0.0447 lb/cf

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Des Moines A-line launcher facility

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.4
CO_2		
CO_{2e}	2.3	9.9

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Des Moines A-line launcher facility

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}							2.3	9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Grimes Iowa TBS

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.09	0.4
CO_2		
CO_{2e}	2.3	9.9

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Grimes Iowa TBS

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	1	0.00992	1.05%	0.00	0.00	0.01	0.04
Flanges	Gas/Vapor	4	0.00086	1.05%	0.00	0.00	0.00	0.01
Compressor Seals	Gas/Vapor	4	0.0194	1.05%	0.00	0.00	0.08	0.34
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.09	0.39
CO_{2e}							2.3	9.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Beatrice compressor station scrubber valve and pipe

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.01
Individual HAP		
Combined HAP		
Methane	0.18	0.8
CO_2		
CO_{2e}	4.6	20.2

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Beatrice compressor station scrubber valve and pipe

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	16	0.00992	1.05%	0.00	0.01	0.16	0.69
Flanges	Gas/Vapor	32	0.00086	1.05%	0.00	0.00	0.03	0.12
Compressor Seals	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.01	0.18	0.81
CO_{2e}							4.6	20.2

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Guthrie Center compressor station valve and pipe

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.01
Individual HAP		
Combined HAP		
Methane	0.17	0.8
CO_2		
CO_{2e}	4.3	18.9

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Guthrie Center compressor station valve and pipe

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	tons/year	Potential to Emit Methane Emission Rates lbs/hour	tons/year
Valves	Gas/Vapor	15	0.00992	1.05%	0.00	0.01	0.15	0.64
Flanges	Gas/Vapor	30	0.00086	1.05%	0.00	0.00	0.03	0.11
Compressor Seals	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.01	0.17	0.76
CO_{2e}							4.3	18.9

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Oakland compressor station valve and pipe

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.01
Individual HAP		
Combined HAP		
Methane	0.16	0.7
CO_2		
CO_{2e}	4.0	17.7

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Oakland compressor station valve and pipe

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	14	0.00992	1.05%	0.00	0.01	0.14	0.60
Flanges	Gas/Vapor	28	0.00086	1.05%	0.00	0.00	0.02	0.10
Compressor Seals	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.01	0.16	0.71
CO_{2e}							4.0	17.7

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Ogden compressor station valve and pipe

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.00
Individual HAP		
Combined HAP		
Methane	0.07	0.3
CO_2		
CO_{2e}	1.7	7.6

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Ogden compressor station valve and pipe

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	6	0.00992	1.05%	0.00	0.00	0.06	0.26
Flanges	Gas/Vapor	12	0.00086	1.05%	0.00	0.00	0.01	0.04
Compressor Seals	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.00	0.07	0.30
CO_{2e}							1.7	7.6

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Palmyra compressor station valve and pipe

Criteria Pollutant and HAP Operating Emissions

Pollutant	Potential to Emit Facilty lbs/hour	tons/year
CO		
NO_x		
PM_{10}		
$PM_{2.5}$		
SO_2		
VOC	0.00	0.01
Individual HAP		
Combined HAP		
Methane	0.12	0.5
CO_2		
CO_{2e}	2.9	12.6

Federal Energy Regulatory Commission Resource Report No. 9
Northern Natural Gas
Central Mainline Corridor Expansion Project
Palmyra compressor station valve and pipe

Maximum Operation	8,760 hours/year

VOC Pollutant Operating Emissions for Process Piping Fugitive Emissions

Component Type	Type of Service	Number of Components	Oil & Gas Production Emission Factors (lb/hr-component)	Percent VOC	Potential to Emit VOC Emission Rates lbs/hour	Potential to Emit VOC Emission Rates tons/year	Potential to Emit Methane Emission Rates lbs/hour	Potential to Emit Methane Emission Rates tons/year
Valves	Gas/Vapor	10	0.00992	1.05%	0.00	0.00	0.10	0.43
Flanges	Gas/Vapor	20	0.00086	1.05%	0.00	0.00	0.02	0.07
Compressor Seals	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Relief Valves	Gas/Vapor	0	0.0194	1.05%	0.00	0.00	0.00	0.00
Total					0.00	0.01	0.12	0.50
CO_{2e}							2.9	12.6

Notes:
1) Emission Factors from Table 2-1 from *Protocol for Equipment Leak Emission Estimates* ; EPA-453/R-98-017 dated November 1995
2) Percent VOC for Gas/Vapor service based on gas analysis for similar facility

Appendix 9C
Noise Barrier Wall Specifications

Reference: Central Mainline Corridor Expansion Project

ACOUSTIC BARRIER WALL SPECIFICATIONS

HDDs and temporary compression activities associated with the Central Mainline Corridor Expansion Project may require noise mitigation beyond work practice standards to comply with 18 Code of Federal Regulations § 157.206(b)(5)(iii). When Project work is required during the nighttime hours of 10 p.m. –7 a.m. noise mitigation in the form of barrier walls may be implemented by Northern. The decision to implement mitigation is dependant on equipment noise, local background noise, and the efficacy of the proposed abatement strategy.

To allow for flexibility general barrier wall specifications are provided along with sample options and guidelines to increase the efficacy of implemented barrier walls. The layouts of barriers varies depending on the location of nearby NSAs. The layouts are provided as Appendix B.

Any implemented noise barrier walls must adhere to the following guidelines:

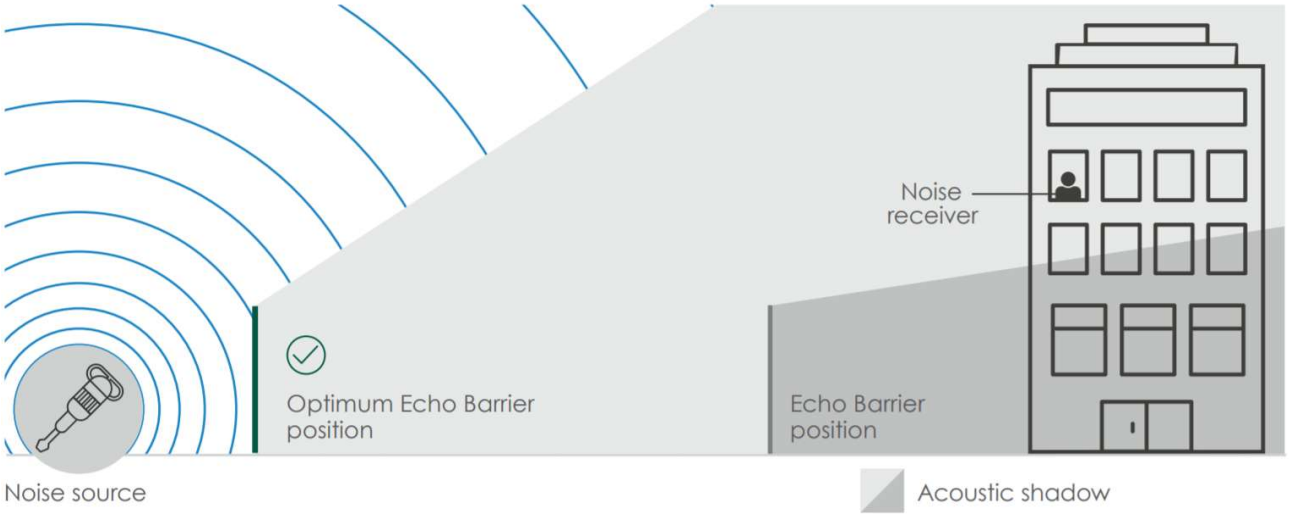
- Barrier walls shall have a minimum face weight or density of 2 to 4 lbs/ft^2. Higher face densities are recommended if possible.
- Barrier walls should be free of gaps. If gaps are present, mass loaded vinyl sheets such as Echo H9 construction barriers may be used to overlap the gaps.
- Barrier walls must be a minimum of 3 feet above the tallest noise source on-site

General recommendations to improve the efficacy of installed noise barriers are as follow:

- The distance between the noise barrier and the noise sources must be minimized to increase the acoustic shadow as shown in Figure 1.
- Absorptive barriers using porous materials are preferred over reflective barriers such as metal or precast concrete. Porous barrier are more effectively able to reduce the impact of noise reflected by parallel barriers

Reference: **Central Mainline Corridor Expansion Project**

Figure 1 – Barrier Wall Location Placement



BARRIER WALL DESIGN

Northern is proposing the following options for barrier wall constructions for HDDs associated with Auburn. Alternative constructions, that adhere to the guidelines and general specifications for noise barriers, may also be implemented.

OPTION 1 – FREE STANDING NOISE BARRIER, BEHRENS SK-8

Galvanized barrier with acoustic infill available in several heights (16',20', and 24'). Are supplied in 8' and 12' lengths. A structural engineer should be retained to confirm that footings provide adequate counterbalance for windloads.

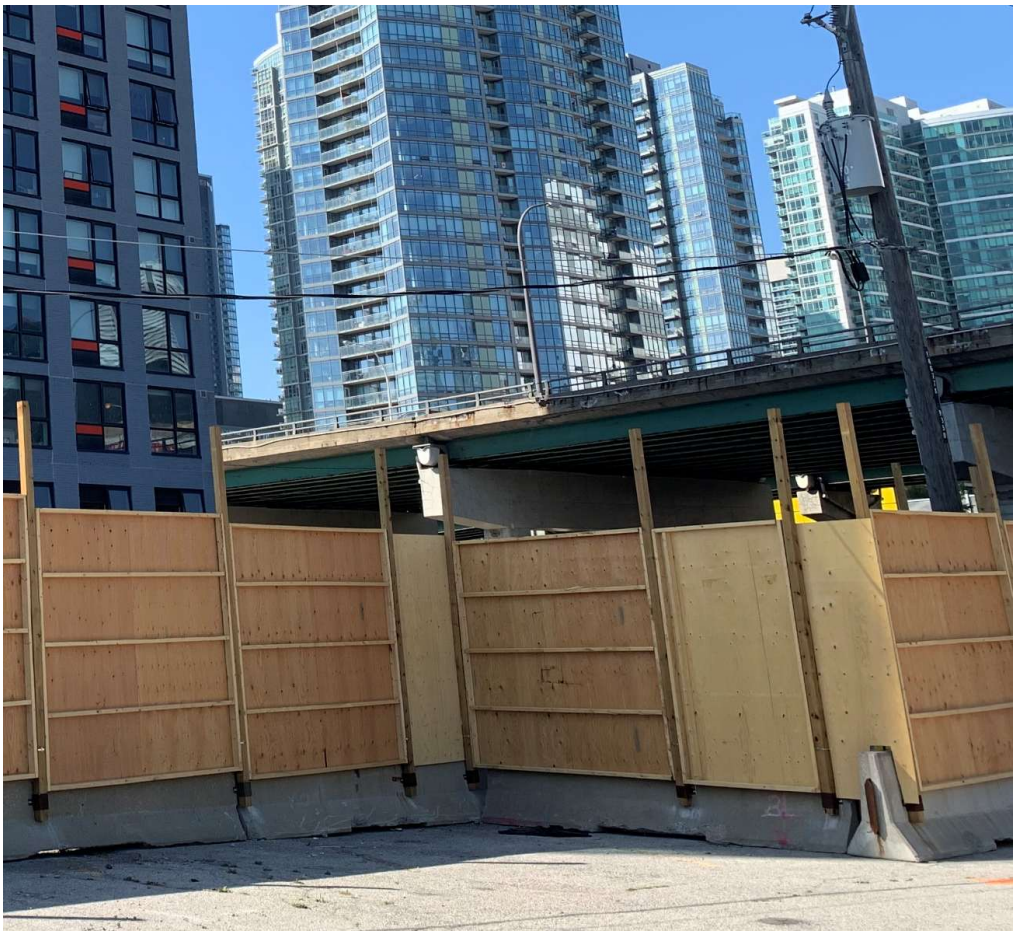
Reference: **Central Mainline Corridor Expansion Project**

Figure 2 – Behrens SK-8 Mobile Noise Barrier

OPTION 2 – JERSEY BARRIER, PLYWOOD/MASS LOADED VINYL COMBINATION

A combination of jersey barrier footings, plywood and wooden posts, and mass loaded vinyl sheets may be used as a noise barrier. A structural engineer should be retained to confirm that footings provide adequate counterbalance for wind loads. Wooden posts should be fastened to jersey barriers using adequate fasteners. Mass loaded vinyl should be attached to plywood to increase noise reduction efficacy.

Figure 3 – Concrete/Wood Acoustic Barriers



OPTION 3 – SEACAN CONTAINER BARRIER

“Seacan” containers, as shown in Figure 3 may be used as noise barriers. Relatively inexpensive, seacan containers are multipurpose noise barriers that may also provide on-site storage in addition to noise mitigation. They require a large site footprint as compared to traditional noise barriers. A structural engineer should be retained to confirm that containers are secured together adequately for wind loading. Containers are available in 40 ft. sections making installation relatively quick compared to options 1, 3, and 4.

Reference: **Central Mainline Corridor Expansion Project**

Figure 4 – Sea Can Container Barrier

OPTION 4 – PRECAST CONCRETE BARRIERS

Precast concrete barriers as shown in Figure 4 may also be used as noise barriers. Generally more expensive option than option 1, 2, 4, precast concrete barriers are much more durable. They are commonly available in 10 ft., 12 ft., and 14 ft. heights.

Figure 5 – Precast Concrete Barriers

OPTION 5 – LOW HEIGHT (<10 FT) BARRIERS

In mitigation scenarios where noise sources are shorter than 7 ft. temporary barriers using mass loaded vinyl sheets may be used such as Echo H9 sheets. Sheets are fastened directly to site hoarding or mesh fences as shown in Figure 5. Applications that require additional height will require a supporting structure of wood or steel, as the mass loaded vinyl sheets provide no structural support.

Reference: **Central Mainline Corridor Expansion Project**

Figure 6 – Echo H9 Loaded Vinyl Sheets on Mesh Fence

Appendix 9D
Identified NSA Locations within 0.5 mile of HDD segments

Omaha

Location	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)	Duration (days)
			Latitude	Longitude		
Omaha 3rd branch line loop (Cass and Sarpy, NE)						
P4-1	OMA-NSA09	Residence at 36719 NE-1	40.9138	-96.1831	370 W	3
	OMA-NSA10	Residence at 36316 NE-1	40.9146	-96.1897	2190 W	
	OMA-NSA11	Residence at 16800 NE-1	40.9151	-96.1746	2000 E	
	OMA-NSA12	Church at 17040 NE-1	40.9155	-96.1775	1250 ENE	
P4-2	OMA-NSA13	Residence at 9090 NE-50	40.9218	-96.1811	2560 SSE	3
	OMA-NSA14	Residence at 9515 NE-50	40.9271	-96.1772	1810 ESE	
	OMA-NSA15	Residence at 37015 Waverly Rd	40.9285	-96.1789	1250 E	
	OMA-NSA16	Residence at 36601 Waverly Rd	40.9285	-96.1862	770 W	
	OMA-NSA17	Residence at 36702 Waverly Rd	40.9291	-96.1841	210 W	
	OMA-NSA18	Residence at 9820 NE-50	40.9311	-96.1788	1450 ENE	
	OMA-NSA19	Residence at 10101 NE-50	40.9337	-96.1768	2460 NE	
P4-3	OMA-NSA23	Residence at 11712 NE-50	40.9536	-96.1790	2070 SE	3
	OMA-NSA24	Residence at 36119 Church Rd	40.9571	-96.1926	2190 W	
	OMA-NSA25	Residence at 37011 Church Rd	40.9575	-96.1790	1570 E	
	OMA-NSA26	Residence at 36505 Church Rd	40.9574	-96.1872	700 W	
	OMA-NSA27	Church at 36712 Church Rd	40.9581	-96.1829	470 E	
	OMA-NSA28	Residence at 36712 Church Rd	40.9582	-96.1836	310 ENE	
	OMA-NSA30	Residence at 12500 NE-50	40.9625	-96.1810	1930 NE	
P4-4	OMA-NSA33	Residence at 35797 River Bank Cir	40.9733	-96.1981	1990 SSW	5
	OMA-NSA34	Residence at 35787 River Bank Cir	40.9748	-96.1985	1510 SSW	
	OMA-NSA35	Residence at 35794 River Bank Cir	40.9752	-96.1990	1420 SSW	
	OMA-NSA37	Residence at 35799 River Rdg Cir	40.9769	-96.1983	800 SW	
	OMA-NSA38	Residence at 35796 River Rdg Cir	40.9776	-96.1985	660 SW	
	OMA-NSA39	Residence at 13834 358th St	40.9788	-96.1979	360 W	
	OMA-NSA40	Residence at 36419 E Park Hwy	40.9790	-96.1883	2300 E	
	OMA-NSA41	Residence at 13906 358th St	40.9800	-96.1978	360 WSW	
	OMA-NSA42	Residence at 35716 E Park Hwy	40.9806	-96.1992	720 W	
	OMA-NSA43	Residence Two at 36012 E Park Hwy	40.9810	-96.1941	720 ENE	
	OMA-NSA44	Residence One at 36012 E Park Hwy	40.9816	-96.1943	770 ENE	
	OMA-NSA45	Residence at 14208 358th St	40.9836	-96.1995	1400 NNW	
	OMA-NSA46	Residence at 14316 358th St	40.9852	-96.1976	1770 N	
	OMA-NSA47	Residence at 36205 Mahoney Rd	40.9863	-96.1925	2420 NNE	
	OMA-NSA48	Residence at 14418 358th St	40.9865	-96.1978	2240 N	
	OMA-NSA49	Residence at 35816 Mahoney Rd	40.9870	-96.1977	2400 N	
P4-5	OMA-NSA41	Residence at 13906 358th St	40.9800	-96.1978	2280 S	3
	OMA-NSA42	Residence at 35716 E Park Hwy	40.9806	-96.1992	2180 SSW	
	OMA-NSA43	Residence Two at 36012 E Park Hwy	40.9810	-96.1941	2020 SSE	
	OMA-NSA44	Residence One at 36012 E Park Hwy	40.9816	-96.1943	1790 SSE	
	OMA-NSA45	Residence at 14208 358th St	40.9836	-96.1995	1250 SW	

Location	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)	Duration (days)
			Latitude	Longitude		
Omaha 3rd branch line loop (Cass and Sarpy, NE)						
P4-5	OMA-NSA46	Residence at 14316 358th St	40.9852	-96.1976	470 SW	3
	OMA-NSA47	Residence at 36205 Mahoney Rd	40.9863	-96.1925	1130 E	
	OMA-NSA48	Residence at 14418 358th St	40.9865	-96.1978	360 WNW	
	OMA-NSA49	Residence at 35816 Mahoney Rd	40.9870	-96.1977	340 W	
	OMA-NSA50	Residence at 36110 Mahoney Rd	40.9887	-96.1936	1030 NE	
	OMA-NSA51	Residence at 36328 Mahoney Rd	40.9903	-96.1882	2590 ENE	
P4-6	OMA-NSA47	Residence at 36205 Mahoney Rd	40.9863	-96.1925	2420 SSE	45
	OMA-NSA48	Residence at 14418 358th St	40.9865	-96.1978	2230 SSW	
	OMA-NSA49	Residence at 35816 Mahoney Rd	40.9870	-96.1977	2060 SSW	
	OMA-NSA50	Residence at 36110 Mahoney Rd	40.9887	-96.1936	1480 SSE	
	OMA-NSA51	Residence at 36328 Mahoney Rd	40.9903	-96.1882	2240 ESE	
	OMA-NSA52	Residence at 36418 Mahoney Rd	40.9920	-96.1876	2290 E	
	OMA-NSA53	Residence at 36438 Mahoney Rd	40.9937	-96.1876	2310 E	
	OMA-NSA54	Residence at 36454 Mahoney Rd	40.9943	-96.1872	2490 ENE	
	OMA-NSA56	Residence at 36468 Mahoney Rd	40.9972	-96.1892	2530 NE	
	OMA-NSA64	Residence at 17503 NE-31	41.0122	-96.1888	2590 NE	

Princeton

Location	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)	Duration (days)
			Latitude	Longitude		
NPPD Princeton Road power station branch line (Gage and Lancaster, NE)						
P4-1	PRB-NSA05	Residence at 8582 E Aspen Rd	40.4802	-96.6046	1560 ENE	4
	PRB-NSA06	Residence at 8239 E Aspen Rd	40.4789	-96.6093	210 NNE	
	PRB-NSA07	Residence at 3927 State Hwy Spur 34B	40.4823	-96.6109	1320 N	
	PRB-NSA08	Residence at 4641 State Hwy Spur 34B	40.4752	-96.6108	1220 SSW	
P4-2	PRB-NSA09	Residence at 7044 E Aspen Rd	40.4813	-96.6253	1500 S	8
	PRB-NSA10	Residence at 3402 S 68 Rd	40.4881	-96.6272	630 NNE	
	PRB-NSA11	Residence at 6837 E Aspen Rd	40.4794	-96.6280	2340 SSW	
P4-3	PRB-NSA17	Residence at 2610 E Apple Rd	40.5093	-96.6838	1250 W	4
	PRB-NSA19	Residence at 1922 S 25 Rd	40.5031	-96.6842	2520 SW	
	PRB-NSA20	Residence at 1234 S 25 Rd	40.5105	-96.6847	1570 WNW	
P4-4	PRB-NSA21	Residence at 1944 E Apple Rd	40.5093	-96.6944	2460 SE	19
	PRB-NSA22	Residence at 1900 E Apple Rd	40.5094	-96.6964	2010 SE	
	PRB-NSA23	Residence at 1526 E Apple Rd	40.5094	-96.7008	1450 S	
	PRB-NSA24	Residence at 1820 E Apple Rd	40.5094	-96.7011	1440 S	
	PRB-NSA25	Residence at 244 E 1st St	40.5095	-96.7018	1410 S	
	PRB-NSA26	Residence at 150 N Vermont St	40.5099	-96.7028	1330 SSW	
	PRB-NSA27	Residence at 155 N Vermont St	40.5099	-96.7033	1380 SSW	
	PRB-NSA28	Residence at 200 N Sherman St	40.5103	-96.7040	1310 SW	
	PRB-NSA29	Residence at 729 S 12th St	40.5157	-96.7048	1100 ENE	
	PRB-NSA30	Residence at 1201 S 12th St	40.5105	-96.7048	1380 SW	
	PRB-NSA31	Residence at 451 S 12th St	40.5182	-96.7058	1650 NNE	
	PRB-NSA32	Residence at 300 W Highland St	40.5104	-96.7072	1330 S	
	PRB-NSA33	Residence at 350 W Highland St	40.5102	-96.7080	1380 S	
	PRB-NSA34	Residence at 205 N Lincoln Ave	40.5104	-96.7087	1340 S	
P4-5	PRB-NSA37	Residence at 1350 W Hallam Rd	40.5382	-96.7412	780 W	5
	PRB-NSA38	Residence at 28500 SW 14th St	40.5330	-96.7410	1610 SSW	
	PRB-NSA39	Residence at 28100 SW 14th St	40.5372	-96.7413	800 W	
	PRB-NSA42	Residence at 27303 SW 14th St	40.5440	-96.7426	2330 NNW	
P4-6	PRB-NSA42	Residence at 27303 SW 14th St	40.5440	-96.7426	2180 SSW	9
P4-7	PRB-NSA48	Residence at 2601 W Princeton Rd	40.5660	-96.7572	2370 SE	9
	PRB-NSA49	Residence at 24500 SW 29th St	40.5715	-96.7608	1010 ENE	
	PRB-NSA50	Residence at 25137 SW 29th St	40.5659	-96.7619	1610 SSE	
	PRB-NSA51	Residence at 24301 SW 29th St	40.5728	-96.7631	1050 NNE	
	PRB-NSA52	Residence at 3300 W Princeton Rd	40.5688	-96.7676	460 S	

Appendix 9E
Estimated Noise Impacts Due to the Project HDDs

Appendix 9E – Estimated Noise Impact due to Project HDDs – Omaha 3rd Branch Line Loop									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures[3]**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
P4-1 (Daytime Only)									
OMA-NSA09	40.9138	-96.1831	370 W	40	62	62	N/A - Daytime Only	62	22
OMA-NSA10	40.9146	-96.1897	2190 W	40	45	45	N/A - Daytime Only	46	6
OMA-NSA11	40.9151	-96.1746	2000 E	40	46	46	N/A - Daytime Only	47	7
OMA-NSA12	40.9155	-96.1775	1250 ENE	40	51	51	N/A - Daytime Only	51	11
P4-2 (Daytime Only)									
OMA-NSA13	40.9218	-96.1811	2560 SSE	40	44	44	N/A - Daytime Only	45	5
OMA-NSA14	40.9271	-96.1772	1810 ESE	38	47	47	N/A - Daytime Only	48	10
OMA-NSA15	40.9285	-96.1789	1250 E	38	51	51	N/A - Daytime Only	51	13
OMA-NSA16	40.9285	-96.1862	770 W	38	55	55	N/A - Daytime Only	55	17
OMA-NSA17	40.9291	-96.1841	210 W	38	67	67	N/A - Daytime Only	67	29
OMA-NSA18	40.9311	-96.1788	1450 ENE	38	49	49	N/A - Daytime Only	50	12
OMA-NSA19	40.9337	-96.1768	2460 NE	38	44	44	N/A - Daytime Only	45	7
P4-3 (Daytime Only)									
OMA-NSA23	40.9536	-96.1790	2070 SE	40	46	46	N/A - Daytime Only	47	7
OMA-NSA24	40.9571	-96.1926	2190 W	40	45	45	N/A - Daytime Only	47	7
OMA-NSA25	40.9575	-96.1790	1570 E	40	49	49	N/A - Daytime Only	49	9
OMA-NSA26	40.9574	-96.1872	700 W	40	56	56	N/A - Daytime Only	56	16
OMA-NSA27	40.9581	-96.1829	470 E	40	60	60	N/A - Daytime Only	60	20
OMA-NSA28	40.9582	-96.1836	310 ENE	40	63	63	N/A - Daytime Only	63	23
OMA-NSA30	40.9625	-96.1810	1930 NE	40	47	47	N/A - Daytime Only	47	7
P4-4 (Daytime Only)									
OMA-NSA33	40.9733	-96.1981	1990 SSW	34	46	46	N/A - Daytime Only	46	12
OMA-NSA34	40.9748	-96.1985	1510 SSW	34	49	49	N/A - Daytime Only	49	15

Appendix 9E – Estimated Noise Impact due to Project HDDs – Omaha 3rd Branch Line Loop									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures[3]**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
OMA-NSA35	40.9752	-96.1990	1420 SSW	34	49	49	N/A - Daytime Only	49	15
OMA-NSA37	40.9769	-96.1983	800 SW	34	54	54	N/A - Daytime Only	54	20
OMA-NSA38	40.9776	-96.1985	660 SW	34	56	56	N/A - Daytime Only	56	22
OMA-NSA39	40.9788	-96.1979	360 W	34	62	62	N/A - Daytime Only	62	28
OMA-NSA40	40.9790	-96.1883	2300 E	34	45	45	N/A - Daytime Only	45	11
OMA-NSA41	40.9800	-96.1978	360 WSW	34	62	62	N/A - Daytime Only	62	28
OMA-NSA42	40.9806	-96.1992	720 W	34	55	55	N/A - Daytime Only	55	21
OMA-NSA43	40.9810	-96.1941	720 ENE	34	55	55	N/A - Daytime Only	55	21
OMA-NSA44	40.9816	-96.1943	770 ENE	34	55	55	N/A - Daytime Only	55	21
OMA-NSA45	40.9836	-96.1995	1400 NNW	41	49	49	N/A - Daytime Only	50	9
OMA-NSA46	40.9852	-96.1976	1770 N	41	47	47	N/A - Daytime Only	48	7
OMA-NSA47	40.9863	-96.1925	2420 NNE	37	44	44	N/A - Daytime Only	45	8
OMA-NSA48	40.9865	-96.1978	2240 N	41	45	45	N/A - Daytime Only	46	5
OMA-NSA49	40.9870	-96.1977	2400 N	41	44	44	N/A - Daytime Only	46	5
P4-5 (Daytime Only)									
OMA-NSA41	40.9800	-96.1978	2280 S	34	45	45	N/A - Daytime Only	45	11
OMA-NSA42	40.9806	-96.1992	2180 SSW	34	45	45	N/A - Daytime Only	46	12
OMA-NSA43	40.9810	-96.1941	2020 SSE	34	46	46	N/A - Daytime Only	46	12
OMA-NSA44	40.9816	-96.1943	1790 SSE	34	47	47	N/A - Daytime Only	47	13
OMA-NSA45	40.9836	-96.1995	1250 SW	41	51	51	N/A - Daytime Only	51	10
OMA-NSA46	40.9852	-96.1976	470 SW	41	60	60	N/A - Daytime Only	60	19
OMA-NSA47	40.9863	-96.1925	1130 E	37	52	52	N/A - Daytime Only	52	15
OMA-NSA48	40.9865	-96.1978	360 WNW	41	62	62	N/A - Daytime Only	62	21
OMA-NSA49	40.9870	-96.1977	340 W	41	63	63	N/A - Daytime Only	63	22

Appendix 9E – Estimated Noise Impact due to Project HDDs – Omaha 3rd Branch Line Loop									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures[3]**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
OMA-NSA50	40.9887	-96.1936	1030 NE	37	52	52	N/A - Daytime Only	53	16
OMA-NSA51	40.9903	-96.1882	2590 ENE	37	44	44	N/A - Daytime Only	44	7
P4-6 (Daytime and Nighttime)									
OMA-NSA47	40.9863	-96.1925	2420 SSE	37	52	49	-	50	13
OMA-NSA48	40.9865	-96.1978	2230 SSW	41	53	50	-	51	10
OMA-NSA49	40.9870	-96.1977	2060 SSW	41	54	51	-	51	10
OMA-NSA50	40.9887	-96.1936	1480 SSE	37	57	54	Predicted noncompliance with FERC L_{dn} limits. Mitigation measure 'A' required.	54	17
OMA-NSA51	40.9903	-96.1882	2240 ESE	37	53	50	-	50	13
OMA-NSA52	40.9920	-96.1876	2290 E	37	53	50	-	50	13
OMA-NSA53	40.9937	-96.1876	2310 E	37	53	50	-	50	13
OMA-NSA54	40.9943	-96.1872	2490 ENE	37	52	49	-	49	12
OMA-NSA56	40.9972	-96.1892	2530 NE	37	51	48	-	49	12
OMA-NSA64	41.0122	-96.1888	2590 NE	38	51	48	-	49	11

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if HDD operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.
3. Noise Mitigation Measures:
   A. Institute work practices such as reduced idling or changes to equipment layout and orientation. A 3 dB drop in overall sound levels is assumed.
   B. Utilize a smaller and modernized HDD rig compared to what is assumed in the modelling.
   C. Install sound barrier walls between the entry pit and NSAs or a barrier wall between the exit pit and NSA, whichever is closest.
   D. Install sound barrier walls between entry and exit pits and NSAs.
   For options C and D, the minimum noise barrier wall height is 20 feet with a minimum surface density of 2 lb/ft^2 or a minimum STC rating of 25.

Appendix 9E – Estimated Noise Impact due to Project HDDs – NPPD Princeton Road Power Station Branch Line									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures[3]**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
P4-1 (Daytime Only)									
PRB-NSA05	40.4802	-96.6046	1560 ENE	31	49	49	N/A - Daytime Only	49	18
PRB-NSA06	40.4789	-96.6093	210 NNE	31	67	67	N/A - Daytime Only	67	36
PRB-NSA07	40.4823	-96.6109	1320 N	31	50	50	N/A - Daytime Only	50	19
PRB-NSA08	40.4752	-96.6108	1220 SSW	31	51	51	N/A - Daytime Only	51	20
P4-2 (Daytime Only)									
PRB-NSA09	40.4813	-96.6253	1500 S	28	49	49	N/A - Daytime Only	49	21
PRB-NSA10	40.4881	-96.6272	630 NNE	28	57	57	N/A - Daytime Only	57	29
PRB-NSA11	40.4794	-96.6280	2340 SSW	28	45	45	N/A - Daytime Only	45	17
P4-3 (Daytime Only)									
PRB-NSA17	40.5093	-96.6838	1250 W	30	51	51	N/A - Daytime Only	51	21
PRB-NSA19	40.5031	-96.6842	2520 SW	30	44	44	N/A - Daytime Only	44	14
PRB-NSA20	40.5105	-96.6847	1570 WNW	30	48	48	N/A - Daytime Only	49	19
P4-4 (Daytime and Nighttime)									
PRB-NSA21	40.5093	-96.6944	2460 SE	30	52	50	-	50	20
PRB-NSA22	40.5094	-96.6964	2010 SE	30	54	52	-	52	22
PRB-NSA23	40.5094	-96.7008	1450 S	44	57	53	Predicted noncompliance with FERC L_{dn} limits. Mitigation measure 'A' and 'D' required.	53	9
PRB-NSA24	40.5094	-96.7011	1440 S	44	57	53		53	9
PRB-NSA25	40.5095	-96.7018	1410 S	44	58	52		53	9
PRB-NSA26	40.5099	-96.7028	1330 SSW	44	58	52		53	9
PRB-NSA27	40.5099	-96.7033	1380 SSW	44	58	52		53	9
PRB-NSA28	40.5103	-96.7040	1310 SW	44	59	53		53	9
PRB-NSA29	40.5157	-96.7048	1100 ENE	44	60	55		55	11
PRB-NSA30	40.5105	-96.7048	1380 SW	44	58	53		54	10

Appendix 9E – Estimated Noise Impact due to Project HDDs – NPPD Princeton Road Power Station Branch Line									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures[3]**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
PRB-NSA31	40.5182	-96.7058	1650 NNE	44	56	54	Predicted noncompliance with FERC L_{dn} limits. Mitigation measure 'A' and 'D' required.	54	10
PRB-NSA32	40.5104	-96.7072	1330 S	44	58	55		55	11
PRB-NSA33	40.5102	-96.7080	1380 S	44	58	55		55	11
PRB-NSA34	40.5104	-96.7087	1340 S	44	58	55		55	11
P4-5 (Daytime Only)									
PRB-NSA37	40.5382	-96.7412	780 W	34	55	55	N/A - Daytime Only	55	21
PRB-NSA38	40.5330	-96.7410	1610 SSW	34	48	48	N/A - Daytime Only	48	14
PRB-NSA39	40.5372	-96.7413	800 W	34	55	55	N/A - Daytime Only	55	21
PRB-NSA42	40.5440	-96.7426	2330 NNW	34	45	45	N/A - Daytime Only	45	11
P4-6 (Daytime Only)									
PRB-NSA42	40.5440	-96.7426	2180 SSW	34	45	45	N/A - Daytime Only	45	11
P4-7 (Daytime Only)									
PRB-NSA48	40.5660	-96.7572	2370 SE	32	44	44	N/A - Daytime Only	44	12
PRB-NSA49	40.5715	-96.7608	1010 ENE	32	52	52	N/A - Daytime Only	52	20
PRB-NSA50	40.5659	-96.7619	1610 SSE	32	48	48	N/A - Daytime Only	48	16
PRB-NSA51	40.5728	-96.7631	1050 NNE	32	52	52	N/A - Daytime Only	52	20
PRB-NSA52	40.5688	-96.7676	460 S	32	60	60	N/A - Daytime Only	60	28

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if HDD operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.
3. Noise Mitigation Measures:
   A. Institute work practices such as reduced idling or changes to equipment layout and orientation. A 3 dB drop in overall sound levels is assumed.
   B. Utilize a smaller and modernized HDD rig compared to what is assumed in the modelling.
   C. Install sound barrier walls between the entry pit and NSAs or a barrier wall between the exit pit and NSA, whichever is closest.
   D. Install sound barrier walls between entry and exit pits and NSAs.
   For options C and D, the minimum noise barrier wall height is 20 feet with a minimum surface density of 2 lb/ft^2 or a minimum STC rating of 25.

Appendix 9F
Identified NSA Locations within 1 mile of Temporary Compression and Flaring

Palmyra Compressor Station

Activity	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)
			Latitude	Longitude	
Palmyra Compressor Station (Otoe, NE)					
Temporary Compression	PCS-NSA01	Residence at 3499 N 6th Rd	40.7389	-96.3754	3410 SW
	PCS-NSA02	Residence at 1126 D Rd	40.7399	-96.3552	4520 SE
	PCS-NSA03	Residence at 1024 D Rd	40.7399	-96.3655	2680 SSE
	PCS-NSA04	Residence at 881 D Rd	40.7409	-96.3787	3490 SW
	PCS-NSA05	Residence at 1129 N 8th Rd	40.7425	-96.3868	5240 WSW
	PCS-NSA06	Residence at 1157 N 10th Rd	40.7444	-96.3683	880 S
	PCS-NSA07	Residence at 1170 N 10th Rd	40.7483	-96.3678	580 NNE
	PCS-NSA08	Residence at 892 C Rd	40.7529	-96.3777	3320 NW
	PCS-NSA09	Residence at 1264 N 8th Rd	40.7529	-96.3854	5120 WNW
	PCS-NSA10	Residence at 836 C Rd	40.7533	-96.3829	4560 WNW
	PCS-NSA11	Residence at 856 C Rd	40.7542	-96.3810	4300 NW
	PCS-NSA12	Residence at 909 C Rd	40.7552	-96.3762	3670 NNW
Flare Operation	PCS-NSA01	Residence at 3499 N 6th Rd	40.7389	-96.3754	3450 SW
	PCS-NSA02	Residence at 1126 D Rd	40.7399	-96.3552	4550 SE
	PCS-NSA03	Residence at 1024 D Rd	40.7399	-96.3655	2730 SSE
	PCS-NSA04	Residence at 881 D Rd	40.7409	-96.3787	3520 SW
	PCS-NSA05	Residence at 1129 N 8th Rd	40.7425	-96.3868	5250 WSW
	PCS-NSA06	Residence at 1157 N 10th Rd	40.7444	-96.3683	930 S
	PCS-NSA07	Residence at 1170 N 10th Rd	40.7483	-96.3678	570 NNE
	PCS-NSA08	Residence at 892 C Rd	40.7529	-96.3777	3310 NW
	PCS-NSA09	Residence at 1264 N 8th Rd	40.7529	-96.3854	5110 WNW
	PCS-NSA10	Residence at 836 C Rd	40.7533	-96.3829	4550 WNW
	PCS-NSA11	Residence at 856 C Rd	40.7542	-96.3810	4290 NW
	PCS-NSA12	Residence at 909 C Rd	40.7552	-96.3762	3660 NNW

Ogden Compressor Station

Activity	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)
			Latitude	Longitude	
Ogden Compressor Station (Boone, IA)					
Temporary Compression	OCS-NSA01	Residence at 1151 G Ave	42.0417	-94.0481	1740 SSW
	OCS-NSA02	Residence at 726 W Cherry St	42.0438	-94.0376	2080 ESE
	OCS-NSA03	Residence at 720 W Chestnut St	42.0448	-94.0370	2130 E
	OCS-NSA04	Residence at 645 210th St	42.0495	-94.0386	2140 NE
	OCS-NSA05	Residence at 613 210th St	42.0493	-94.0436	1300 NNE
	OCS-NSA06	Residence at 607 210th St	42.0493	-94.0461	1310 NNW
	OCS-NSA07	Residence at 595 210th St	42.0495	-94.0481	1600 NNW
Flare Operation	OCS-NSA01	Residence at 1151 G Ave	42.0417	-94.0481	1730 SSW
	OCS-NSA02	Residence at 726 W Cherry St	42.0438	-94.0376	2130 ESE
	OCS-NSA03	Residence at 720 W Chestnut St	42.0448	-94.0370	2170 E
	OCS-NSA04	Residence at 645 210th St	42.0495	-94.0386	2180 NE
	OCS-NSA05	Residence at 613 210th St	42.0493	-94.0436	1310 NNE
	OCS-NSA06	Residence at 607 210th St	42.0493	-94.0461	1310 NNW
	OCS-NSA07	Residence at 595 210th St	42.0495	-94.0481	1590 NNW

Valve 5

Activity	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)
			Latitude	Longitude	
Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 Setting (Lancaster, NE)					
Temporary Compression	PRB-NSA54	Residence at 12829 E Gage Rd	40.5234	-96.5480	1360 W
	PRB-NSA55	Residence at 12601 E Gage Rd	40.5228	-96.5504	2060 W
	PRB-NSA56	Residence at 12511 E Gage Rd	40.5233	-96.5517	2410 W
	PRB-NSA57	Residence at 12455 E Gage Rd	40.5233	-96.5527	2690 W
	PRB-NSA58	Residence at 12600 E Gage Rd	40.5245	-96.5507	2130 W
	PRB-NSA59	Residence at 13481 E Gage Rd	40.5232	-96.5388	1210 ESE
	PRB-NSA60	Residence at 28300 Post Rock Cir	40.5352	-96.5507	4640 NNW
	PRB-NSA61	Residence at 14444 E Gage Rd	40.5243	-96.5250	5020 E
Flare Operation	PRB-NSA54	Residence at 12829 E Gage Rd	40.5234	-96.5480	1330 W
	PRB-NSA55	Residence at 12601 E Gage Rd	40.5228	-96.5504	2030 W
	PRB-NSA56	Residence at 12511 E Gage Rd	40.5233	-96.5517	2380 W
	PRB-NSA57	Residence at 12455 E Gage Rd	40.5233	-96.5527	2650 W
	PRB-NSA58	Residence at 12600 E Gage Rd	40.5245	-96.5507	2100 W
	PRB-NSA59	Residence at 13481 E Gage Rd	40.5232	-96.5388	1240 ESE
	PRB-NSA60	Residence at 28300 Post Rock Cir	40.5352	-96.5507	4660 NNW
	PRB-NSA61	Residence at 14444 E Gage Rd	40.5243	-96.5250	5060 E

Royal Estates

Activity	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)
			Latitude	Longitude	
Royal Estates Reducing Station (Polk, IA)					
Temporary Compression	RER-NSA01	Residence at 33914 Yuma Ln	41.7720	-93.8156	420 WSW
	RER-NSA02	Residence at 11405 NW 142nd St	41.7689	-93.8141	1340 S
	RER-NSA03	Residence at 18102 Xavier Ave	41.7752	-93.8236	2710 WNW
	RER-NSA04	Residence at 33914 Yuma Ln	41.7753	-93.8163	1130 NNW
	RER-NSA07	Residence at 13303 NW 120th Ave	41.7809	-93.8013	4670 NE
	RER-NSA08	Residence at 11730 NW 142nd St	41.7771	-93.8142	1670 N

Appendix 9G
Estimated Noise Impacts Due to Project Temporary Compression and Flaring

Appendix 9G – Estimated Noise Impact Due to Project Temporary Compression and Flaring – Palmyra Compressor Station									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
Temporary Compression, Daytime and Nighttime									
PCS-NSA01	40.7389	-96.3754	3410 SW	39	49	40	-	43	4
PCS-NSA02	40.7399	-96.3552	4520 SE	39	46	39	-	42	3
PCS-NSA03	40.7399	-96.3655	2680 SSE	39	52	46	-	47	8
PCS-NSA04	40.7409	-96.3787	3490 SW	39	49	45	-	46	7
PCS-NSA05	40.7425	-96.3868	5240 WSW	39	44	44	-	45	6
PCS-NSA06	40.7444	-96.3683	880 S	39	62	52	Predicted noncompliance with FERC L_{dn} limits. Noise barrier wall required.[3]	52	13
PCS-NSA07	40.7483	-96.3678	580 NNE	39	66	54		54	15
PCS-NSA08	40.7529	-96.3777	3320 NW	39	49	41	-	43	4
PCS-NSA09	40.7529	-96.3854	5120 WNW	39	44	43	-	44	5
PCS-NSA10	40.7533	-96.3829	4560 WNW	39	46	42	-	44	5
PCS-NSA11	40.7542	-96.3810	4300 NW	39	47	43	-	44	5
PCS-NSA12	40.7552	-96.3762	3670 NNW	39	48	39	-	42	3
Flare Operation, Daytime Only									
PCS-NSA01	40.7389	-96.3754	3450 SW	39	47	47	N/A - Daytime Only	48	9
PCS-NSA02	40.7399	-96.3552	4550 SE	39	45	45	N/A - Daytime Only	46	7
PCS-NSA03	40.7399	-96.3655	2730 SSE	39	50	50	N/A - Daytime Only	50	11
PCS-NSA04	40.7409	-96.3787	3520 SW	39	47	47	N/A - Daytime Only	48	9
PCS-NSA05	40.7425	-96.3868	5250 WSW	39	43	43	N/A - Daytime Only	44	5
PCS-NSA06	40.7444	-96.3683	930 S	39	60	60	N/A - Daytime Only	60	21
PCS-NSA07	40.7483	-96.3678	570 NNE	39	68	68	N/A - Daytime Only	68	29
PCS-NSA08	40.7529	-96.3777	3310 NW	39	48	48	N/A - Daytime Only	49	10

Appendix 9G – Estimated Noise Impact Due to Project Temporary Compression and Flaring – Palmyra Compressor Station									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
PCS-NSA09	40.7529	-96.3854	5110 WNW	39	43	43	N/A - Daytime Only	45	6
PCS-NSA10	40.7533	-96.3829	4550 WNW	39	44	44	N/A - Daytime Only	46	7
PCS-NSA11	40.7542	-96.3810	4290 NW	39	45	45	N/A - Daytime Only	46	7
PCS-NSA12	40.7552	-96.3762	3660 NNW	39	47	47	N/A - Daytime Only	48	9

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.
3. The minimum surface density of the barrier is 2 lb/ft^2 or the minimum STC rating is 25. The minimum absorption rating is an NRC of 0.7.

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Appendix 9G – Estimated Noise Impact Due to Project Temporary Compression and Flaring – Ogden Compressor Station									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
Temporary Compression, Daytime and Nighttime									
OCS-NSA01	42.0417	-94.0481	1740 SSW	57	55	55	-	59	2
OCS-NSA02	42.0438	-94.0376	2080 ESE	57	53	41	-	57	0
OCS-NSA03	42.0448	-94.0370	2130 E	57	53	41	-	57	0
OCS-NSA04	42.0495	-94.0386	2140 NE	57	53	42	-	57	0
OCS-NSA05	42.0493	-94.0436	1300 NNE	57	58	51	Predicted noncompliance with FERC L_{dn} limits. Noise barrier wall required.[3]	58	1
OCS-NSA06	42.0493	-94.0461	1310 NNW	57	58	55		59	2
OCS-NSA07	42.0495	-94.0481	1600 NNW	57	56	55		59	2
Flare Operation, Daytime Only									
OCS-NSA01	42.0417	-94.0481	1730 SSW	57	57	57	N/A - Daytime Only	60	3
OCS-NSA02	42.0438	-94.0376	2130 ESE	57	55	55	N/A - Daytime Only	59	2
OCS-NSA03	42.0448	-94.0370	2170 E	57	54	54	N/A - Daytime Only	59	2
OCS-NSA04	42.0495	-94.0386	2180 NE	57	54	54	N/A - Daytime Only	59	2
OCS-NSA05	42.0493	-94.0436	1310 NNE	57	59	59	N/A - Daytime Only	61	4
OCS-NSA06	42.0493	-94.0461	1310 NNW	57	59	59	N/A - Daytime Only	61	4
OCS-NSA07	42.0495	-94.0481	1590 NNW	57	58	58	N/A - Daytime Only	60	3

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.
3. The minimum surface density of the barrier is 2 lb/ft^2 or the minimum STC rating is 25.

Appendix 9G – Estimated Noise Impact Due to Project Temporary Compression and Flaring – Beatrice to Palmyra D-line and Beatrice to Palmyra E-line Block Valve 5 Setting									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
Temporary Compression, Daytime and Nighttime									
PRB-NSA54	40.5234	-96.5480	1360 W	38	60	52	Predicted noncompliance with FERC L_{dn} limits. Noise barrier wall required.[3]	52	14
PRB-NSA55	40.5228	-96.5504	2060 W	38	56	50		50	12
PRB-NSA56	40.5233	-96.5517	2410 W	38	54	49	-	50	12
PRB-NSA57	40.5233	-96.5527	2690 W	38	53	49	-	49	11
PRB-NSA58	40.5245	-96.5507	2130 W	38	56	51	Predicted noncompliance with FERC L_{dn} limits. Noise barrier wall required.[3]	51	13
PRB-NSA59	40.5232	-96.5388	1210 ESE	41	61	53		53	12
PRB-NSA60	40.5352	-96.5507	4640 NNW	38	47	47	-	47	9
PRB-NSA61	40.5243	-96.5250	5020 E	41	46	40	-	44	3
Flare Operation, Daytime Only									
PRB-NSA54	40.5234	-96.5480	1330 W	38	59	59	N/A - Daytime Only	59	21
PRB-NSA55	40.5228	-96.5504	2030 W	38	55	55	N/A - Daytime Only	55	17
PRB-NSA56	40.5233	-96.5517	2380 W	38	53	53	N/A - Daytime Only	53	15
PRB-NSA57	40.5233	-96.5527	2650 W	38	52	52	N/A - Daytime Only	52	14
PRB-NSA58	40.5245	-96.5507	2100 W	38	54	54	N/A - Daytime Only	54	16
PRB-NSA59	40.5232	-96.5388	1240 ESE	41	60	60	N/A - Daytime Only	60	19
PRB-NSA60	40.5352	-96.5507	4660 NNW	38	46	46	N/A - Daytime Only	46	8
PRB-NSA61	40.5243	-96.5250	5060 E	41	45	45	N/A - Daytime Only	46	5

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.
3. The minimum surface density of the barrier is 2 lb/ft^2 or the minimum STC rating is 25. The minimum absorption rating is an NRC of 0.7.

Appendix 9G – Estimated Noise Impact Due to Project Temporary Compression – Royal Estates Reducing Station									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
Temporary Compression, Daytime Only									
RER-NSA01	41.7720	-93.8156	420 WSW	59	51	51	N/A - Daytime Only	60	1
RER-NSA02	41.7689	-93.8141	1340 S	59	40	40	N/A - Daytime Only	59	0
RER-NSA03	41.7752	-93.8236	2710 WNW	59	33	33	N/A - Daytime Only	59	0
RER-NSA04	41.7753	-93.8163	1130 NNW	59	42	42	N/A - Daytime Only	59	0
RER-NSA07	41.7809	-93.8013	4670 NE	59	27	27	N/A - Daytime Only	59	0
RER-NSA08	41.7771	-93.8142	1670 N	59	38	38	N/A - Daytime Only	59	0

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.

Appendix 9H
Identified NSA Locations within 1 mile of the Clarion Compressor Station

Clarion Compressor Station

Activity	NSA	NSA Type	Coordinates		Approximate Distance and Direction (ft)
			Latitude	Longitude	
Clarion Compressor Station (Wright, IA)					
All Significant Sources Operational	CCS-NSA04	Residence at 1991 Keokuk Ave	42.7626	-93.7752	3050 E
	CCS-NSA05	Residence at 1956 190th St	42.7713	-93.7848	3390 N
	CCS-NSA06	Residence at 1875 200th St	42.7613	-93.7989	2670 W
	CCS-NSA08	Residence at 1962 190th St	42.7747	-93.7809	4860 NNE

Appendix 9I
Estimated Noise Impacts Due to Operation of the Clarion Compressor Station

Appendix 9I – Estimated Noise Impact Due to the Operation of the Clarion Compressor Station									
Location	**Latitude of NSA**	**Longitude of NSA**	**Distance (ft) and Direction to closest NSA**	**Existing Ambient L_{dn}[1] (dBA)**	**Estimated L_{dn} due to Project Construction without Mitigation (dBA)**	**Estimated L_{dn} due to Project Construction with Proposed Mitigation[2] (dBA)**	**Proposed Mitigation Measures**	**Estimated L_{dn} due to Construction with Proposed Mitigation[2] plus Ambient (dBA)**	**Potential Increase Above Ambient (dB)**
All Sources Operational, Daytime and Nighttime									
CCS-NSA04	42.7626	-93.7752	3050 E	36	46	42	46	-	46
CCS-NSA05	42.7713	-93.7848	3390 N	36	45	42	45	-	46
CCS-NSA06	42.7613	-93.7989	2670 W	39	49	46	49	-	49
CCS-NSA08	42.7747	-93.7809	4860 NNE	36	42	38	42	-	43

Notes:

1. Construction L_{dn} sound levels are calculated without any nighttime component if operations are to occur only during daytime hours. In these instances, nighttime ambient sound levels are assumed to be 10 dB below daytime ambient sound levels when calculating L_{dn} ambient sound levels.
2. If mitigation measures are not predicted to be required, L_{dn} sound levels are based on construction activity without mitigation.

Appendix 9J
Modeling Results for Clarion Compressor Station

Stantec performed air dispersion modeling for the Clarion Compressor Station using version 24142 of AERMOD, the most advanced sequential Gaussian plume model sanctioned by the EPA. Surface and upper air meteorological data for the five-year period of 2020 through 2024 was taken from the Mason City Municipal Airport (KMCW). Mason City Municipal Airport is approximately 56 km northeast of the Clarion Compressor Station.

Receptor elevations were determined using the AERMOD terrain processor (AERMAP), version 24142, which incorporates user-provided receptor locations and electronic terrain files. These GeoTIFF terrain files are publicly available in 1/3 arc-second resolution and were obtained from the USGS in National Elevation Dataset format. The AERMAP domain covers the entire extent of the maps, following the default settings.

A nested Cartesian receptor grid with four tiers centered on the approximate center point of the Clarion Compressor Station was created to evaluate the impacts at the site. The four tiers were structured as follows:

- Tier 1 spacing of 50 meters out to 500 m;
- Tier 2 spacing of 100 meters out to 1.5 km;
- Tier 3 spacing of 250 meters out to 3 km; and
- Tier 4 spacing of 500 meters out to 10 km.

Receptors were also placed at 50-meter intervals around the environmental boundary of the Clarion Compressor Station.

The Building Profile Input Program with Plume Rise Model Enhancements (BPIP-PRIME) version 04274 was used to calculate building downwash parameters for the model analysis. Structures can influence modeling results because of building-induced downwash, which can increase predicted concentrations at receptors in close proximity to stacks. Locations for stacks and buildings were input into BPIP-PRIME using the BPIP input file created from the site plan provided by Northern.

Northern Natural Gas Company - Clarion Compressor Station
Proposed Facility Total PTE

Hourly Emissions

Source	EP #	EU #	Capacity	Hourly Emissions (lb/hr)								
				NO_x	CO	CO_2e	PM10	PM2.5	VOC	SO_2	CH_2O	Total HAP
Compressor Turbine	EP1	EU1	20,843 hp 0 Deg F	9.05	9.19	19,560	1.10	1.10	1.05	9.54	0.12	0.17
Emergency Generator	EP2	EU2	908 HP	4.00	8.01	850.59	0.35	0.35	2.00	4.27E-03	0.40	0.58
Equipment Leaks	--	EU3				87.02			0.02			
Blowdowns	--	EU4				194.08			0.05			
Fuel Gas Heater	--	IA	1.24 MMBtu/hr	0.12	0.10	145.20	9.24E-03	9.24E-03	6.69E-03	7.29E-04	9.12E-05	2.29E-03
Space Heaters	--	IA	0.42 MMBtu/hr	0.04	0.02	49.18	3.13E-03	3.13E-03	2.26E-03	2.47E-04	3.09E-05	7.75E-04
Facility PTE				**13.21**	**17.32**	**20,886**	**1.47**	**1.47**	**3.14**	**9.54**	**0.52**	**0.75**
State Modeling Thresholds				9.13	22.80	NA	3.42	2.28	NA	9.13	NA	NA

Annual Emissions

Source	EP #	EU #	Capacity	Annual Emissions (tpy)								
				NO_x	CO	CO_2e	PM10	PM2.5	VOC	SO_2	CH_2O	Total HAP
Compressor Turbine	EP1	EU1	20,843 hp 0 Deg F	44.52	90.96	85,674	4.83	4.83	5.47	0.52	0.52	0.75
Emergency Generator	EP2	EU2	908 HP	1.00	2.00	212.65	0.09	0.09	0.50	1.07E-03	0.10	0.14
Equipment Leaks	--	EU3				381.15			0.11			
Blowdowns	--	EU4				850.08			0.24			
Fuel Gas Heater	--	IA	1.24 MMBtu/hr	0.53	0.45	635.98	0.04	0.04	0.03	3.19E-03	3.99E-04	0.01
Space Heaters	--	IA	0.42 MMBtu/hr	0.17	0.07	215.41	1.37E-02	1.37E-02	9.92E-03	1.08E-03	1.35E-04	3.39E-03
Facility PTE				**46.23**	**93.48**	**87,970**	**4.97**	**4.97**	**6.36**	**0.53**	**0.62**	**0.91**
PSD Major Source Threshold				250	250	n/a	250	250	250	250	n/a	n/a
Title V Threshold				100	100	100,000	100	100	100	100	10	25
Applicability				Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Minor Source	Area Source	Area Source

Northern Natural Gas Company - Clarion Compressor Station
Compressor Turbine - Titan 130-20502S

EP #:	EP1
EU #:	EU1
Description:	Compressor Turbine Solar Titan 130-20502S

Horsepower	20,843	hp (0 °F)
Brake Specific Fuel Consumption	7449	Btu/Bhp-hr (LHV, 0 °F)
Total Heat Input	150.49	MMBtu/hr (LHV, 0 °F)
	167.04	MMBtu/hr (HHV, 0 °F)
Operating Hours	8760	hr/yr
Natural Gas Heat Content	1020	Btu/scf
Fuel Consumption	1434.61	MMscf/yr (based on 0 °F)
	163,768.5	scf/hr (based on 0 °F)
Quantity	1	

Pollutant	Emission Factor[1,2,3]			Emission Rate		Emission Factor Reference
	ppmvd@15%O_2	lb/MMBtu		lb/hr[6]	ton/yr[7]	
NO_x	15.00	0.060	LHV	9.05	44.52	Vendor Data
CO	25.00	0.061	LHV	9.19	90.96	Vendor Data
CO2[4]		117.0	HHV	19,540	85,587	40 CFR 98 Subpart C
CH4[4]		0.002	HHV	0.3683	1.6130	40 CFR 98 Subpart C
N2O[4]		0.0002	HHV	0.0368	0.1613	40 CFR 98 Subpart C
CO_2e[4]		117.1	HHV	19,560	85,674	40 CFR 98 Subpart C
PM_{10}		0.0066	HHV	1.10	4.83	AP-42 Table 3.1-2a (4/00)
$PM_{2.5}$		0.0066	HHV	1.10	4.83	AP-42 Table 3.1-2a (4/00)
VOC	5.00	0.007	LHV	1.05	5.47	Vendor Data (20% of UHC)
SO_2 (Maximum Hourly)		0.0571	HHV	9.54		20 grains S / 100 scf
SO_2 (Average Annual)		0.000714	HHV		0.52	0.25 grains S / 100 scf
Formaldehyde		7.10E-04	HHV	0.12	0.52	AP-42 Table 3.1-3 (4/00)
1,3-Butadiene		4.30E-07	HHV	7.18E-05	3.15E-04	AP-42 Table 3.1-3 (4/00)
Acetaldehyde		4.00E-05	HHV	6.68E-03	2.93E-02	AP-42 Table 3.1-3 (4/00)
Acrolein		6.40E-06	HHV	1.07E-03	4.68E-03	AP-42 Table 3.1-3 (4/00)
Benzene		1.20E-05	HHV	2.00E-03	8.78E-03	AP-42 Table 3.1-3 (4/00)
Ethylbenzene		3.20E-05	HHV	5.35E-03	2.34E-02	AP-42 Table 3.1-3 (4/00)
Naphthalene		1.30E-06	HHV	2.17E-04	9.51E-04	AP-42 Table 3.1-3 (4/00)
PAH		2.20E-06	HHV	3.67E-04	1.61E-03	AP-42 Table 3.1-3 (4/00)
Propylene Oxide		2.90E-05	HHV	4.84E-03	2.12E-02	AP-42 Table 3.1-3 (4/00)
Toluene		1.30E-04	HHV	2.17E-02	9.51E-02	AP-42 Table 3.1-3 (4/00)
Xylene		6.40E-05	HHV	1.07E-02	4.68E-02	AP-42 Table 3.1-3 (4/00)
Total		1.03E-03		1.72E-01	0.75	

Notes:

1. Emission factors for NOX, CO, and VOC obtained from manufacturer data. Vendor Data (20% of UHC). VOC based on 20% of vendor data for unburned hydrocarbon.
2. Emission factors for PM and SO2 based on AP-42 (AP-42 Section 3.1 - Stationary Gas Turbines, Table 3.1-2a). PM = PM10 = PM2.5 is assumed
3. Emission factors for HAPs based on AP-42 factors (AP-42 Section 3.1 - Stationary Gas Turbines, Table 3.1-3).
4. Emission factors based on 40 CFR 98 Subpart C. Updated January 2025.
5. HHV heat input based on HHV=1.11*LHV

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7. Annual emission rate based on combination of potential operating modes as provided on following page for NOx, CO, and VOC. The operating modes are 100 hours at low load (low load hours are based on <50% load), 500 hours at low temp (< 30 °F) and 100 startups and shutdowns per year. The remainder of the hours per year are based on emissions at normal load (60 °F). Normal operation is considered to be 50%-100% load. All other pollutants are based on horsepower and brake specific fuel consumption at 30 °F.

Northern Natural Gas Company - Clarion Compressor Station

Emission Rates per Operating Mode

Operating Mode	Units	NO_x	CO	VOC
Normal Load @ 0°F[1]	lb/hr	9.05	9.19	1.05
Low-Temp @ -20 F	lb/hr	26.2	38.0	2.16
Low-Load (<50%)[3]	lb/hr	20.97	850.77	9.72
Startup/ Shutdown[4]	lb/event	3.00	146.00	16.00

1. Based on data from Solar Centaur Compressor Set Predicted Emission Performance data sheet and the following concentrations:

25 ppm NOx; 50 ppm CO; 25 ppm VOC

2. Based on data from Solar PIL 167 Revision 8.1 (5-16-2022), Table 2 for Titan 130 20502S.
3. For the purpose of calculating potential annual emissions, non-startup/shutdown operation at <50% load is based on emissions data provided by Solar for 40% load.
4. Based on data from Solar PIL 167 Revision 6 (12-1-2016), Table 2 for Titan 130 20502S.

Potential Annual Emissions

Operating Mode	Operating Time		NO_x	CO	VOC
	Cycles	hr/yr	ton/yr	ton/yr	ton/yr
Normal Load @ 0 °F		8153	36.89	37.46	4.29
Low-Temp @ -20 F		500	6.55	9.50	0.54
Low-Load (<40%)		100	1.05	42.54	0.49
Startup/ Shutdown	20	7	0.03	1.46	0.16
Total		8,760	44.52	90.96	5.47

Northern Natural Gas Company - Clarion Compressor Station
Natural-Gas Fired Standby Electric Generator
Generac SG/MG750

EP # EP2
EU # EU2

Rated Mechanical Output: (ISO)

Fuel Consumption:	8,000	Btu/hp-hr	
Fuel Type:	Natural Gas	908	Horsepower
Operating Hours (Limit)	500	hours	

Pollutant	Emission Factor (lb/MMBtu)	Emission Factor (g/hp-hr)	Uncontrolled Emissions (lb/hr)	Uncontrolled Emissions (ton/yr)	Limited and Controlled Emissions (lb/hr)	Limited and Controlled Emissions (ton/yr)
PM^{1}	4.83E-02	--	0.35	1.54E+00	0.35	0.09
$PM_{10}{}^{1}$	4.83E-02	--	0.35	1.54E+00	0.35	0.09
$PM_{2.5}{}^{1}$	4.83E-02	--	0.35	1.54E+00	0.35	0.09
$SO_2{}^{1}$	5.88E-04	--	4.27E-03	1.87E-02	4.27E-03	1.07E-03
$CO_2{}^{3}$	116.98	--	849.72	3721.78	849.72	212.43
$CH_4{}^{3}$	2.20E-03	--	0.02	7.01E-02	0.02	4.00E-03
N_2O^{3}	2.20E-04	--	1.60E-03	7.01E-03	1.60E-03	4.00E-04
CO_2e^{3}	117.10	--	850.59	3725.60	850.59	212.65
$NO_x{}^{2}$		2.00	4.00	17.54	4.00	1.00
VOC^{2}		1.00	2.00	8.77	2.00	0.50
CO^{2}		4.00	8.01	35.07	8.01	2.00

[1] Emission factors based on AP-42, Fifth Edition, Section 3.2 "Natural Gas-Fired Reciprocating Engines", Table 3.2-1 Uncontrolled Emission Factors for 2-Stroke Lean-Burn Engines, 10/24

[2] Emission factors based on 40 CFR Part 60 Subpart JJJJ limits. The vendor guarantee confirms compliance with the NSPS JJJJ limits.

[3] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Uncontrolled Emissions (lb/hr)	Uncontrolled Emissions (ton/yr)	Limited and Controlled Emissions (lb/hr)	Limited and Controlled Emissions (ton/yr)
1,1,2,2-Tetrachloroethane	6.63E-05	4.82E-04	2.11E-03	4.82E-04	1.20E-04
1,1,2-Trichloroethane	5.27E-05	3.83E-04	1.68E-03	3.83E-04	9.57E-05
1,3-Butadiene	8.20E-04	5.96E-03	2.61E-02	5.96E-03	1.49E-03
1,3-Dichloropropene	4.38E-05	3.18E-04	1.39E-03	3.18E-04	7.95E-05
2,2,4-Trimethylpentane	8.46E-04	6.15E-03	2.69E-02	6.15E-03	1.54E-03
Acenaphthene	1.33E-06	9.66E-06	4.23E-05	9.66E-06	2.42E-06
Acenaphthylene	3.17E-06	2.30E-05	1.01E-04	2.30E-05	5.76E-06
Acetaldehyde	7.76E-03	5.64E-02	2.47E-01	5.64E-02	1.41E-02
Acrolein	7.78E-03	5.65E-02	2.48E-01	5.65E-02	1.41E-02
Benzene	1.94E-03	1.41E-02	6.17E-02	1.41E-02	3.52E-03
Biphenyl	3.95E-06	2.87E-05	1.26E-04	2.87E-05	7.17E-06
Carbon Tetrachloride	6.07E-05	4.41E-04	1.93E-03	4.41E-04	1.10E-04
Chlorobenzene	4.44E-05	3.23E-04	1.41E-03	3.23E-04	8.06E-05
Chloroform	4.71E-05	3.42E-04	1.50E-03	3.42E-04	8.55E-05
Ethylbenzene	1.08E-04	7.85E-04	3.44E-03	7.85E-04	1.96E-04
Ethylene Dibromide	7.34E-05	5.33E-04	2.34E-03	5.33E-04	1.33E-04
Formaldehyde	5.52E-02	4.01E-01	1.76E+00	4.01E-01	1.00E-01
Methanol	2.48E-03	1.80E-02	7.89E-02	1.80E-02	4.50E-03
Methylene Chloride	1.47E-04	1.07E-03	4.68E-03	1.07E-03	2.67E-04
n-Hexane	4.45E-04	3.23E-03	1.42E-02	3.23E-03	8.08E-04
Naphthalene	9.63E-05	7.00E-04	3.06E-03	7.00E-04	1.75E-04
Total PAH (w/naphthalene)	1.34E-04	9.73E-04	4.26E-03	9.73E-04	2.43E-04
Phenol	4.21E-05	3.06E-04	1.34E-03	3.06E-04	7.65E-05
Styrene	5.48E-05	3.98E-04	1.74E-03	3.98E-04	9.95E-05
Toluene	9.63E-04	7.00E-03	3.06E-02	7.00E-03	1.75E-03
Vinyl Chloride	2.47E-05	1.79E-04	7.86E-04	1.79E-04	4.49E-05
Xylene	2.68E-04	1.95E-03	8.53E-03	1.95E-03	4.87E-04
Total HAP		**5.77E-01**	**2.53E+00**	**5.77E-01**	**1.44E-01**

[1] Emission factors based on AP-42, Fifth Edition, Section 3.2 "Natural Gas-Fired Reciprocating Engines," Table 3.2-1, 10/24

Methodology
Potential to Emit (lb/hr) = Emission Factor (lb/MMBtu) x 1 MMBtu/1,000,000 Btu x Fuel Use (Btu/hp-hr) x Horsepower (hp)
Potential to Emit (tons/year) = Potential to Emit (lb/hr) x 8,760 hr/yr x 1 ton/2,000 lb

Northern Natural Gas Company - Clarion Compressor Station
Natural Gas Fired Fuel Gas Heater

Firing Capacity: 1.240 MMBTU/hr 0.620 MMBtu/hr per tube, 2 tubes
Heat Value: 1,020 BTU/cf

Pollutant	Emission Factor[1,2] (lb/MMBtu)	Emission Rate (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
PM	7.45E-03	9.24E-03	0.04
PM_{10}	7.45E-03	9.24E-03	0.04
$PM_{2.5}$	7.45E-03	9.24E-03	0.04
SO_2	5.88E-04	7.29E-04	3.19E-03
CO_2[2]	116.98	145.05	635.33
CH_4[2]	2.20E-03	2.73E-03	0.01
N_2O[2]	2.20E-04	2.73E-04	1.20E-03
CO_2e[2]	117.10	145.20	635.98
NO_x	0.098	0.12	0.53
VOC	5.39E-03	6.69E-03	0.03
CO	0.082	0.10	0.45

[1]Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

[2] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Maximum Uncontrolled Emissions (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
2-Methylnaphthalene	2.35E-08	2.92E-08	1.28E-07
3-Methylchloranthrene	1.76E-09	2.19E-09	9.58E-09
7,12-Dibethylbenz(a)anthracene	1.57E-08	1.95E-08	8.52E-08
Acenaphthene	1.76E-09	2.19E-09	9.58E-09
Acenaphthylene	1.76E-09	2.19E-09	9.58E-09
Anthracene	2.35E-09	2.92E-09	1.28E-08
Benz(a)anthracene	1.76E-09	2.19E-09	9.58E-09
Benzene	2.06E-06	2.55E-06	1.12E-05
Benzo(a)pyrene	1.18E-09	1.46E-09	6.39E-09
Benzo(b)fluoranthene	1.76E-09	2.19E-09	9.58E-09
Benzo(b,h,i)perylene	1.18E-09	1.46E-09	6.39E-09
Benzo(k)fluoranthene	1.76E-09	2.19E-09	9.58E-09
Chrysene	1.76E-09	2.19E-09	9.58E-09
Dibenzo(a,h)anthracene	1.18E-09	1.46E-09	6.39E-09
Dichlorobenzene	1.18E-06	1.46E-06	6.39E-06
Fluoranthene	2.94E-09	3.65E-09	1.60E-08
Fluorene	2.75E-09	3.40E-09	1.49E-08
Formaldehyde	7.35E-05	9.12E-05	3.99E-04
Hexane	1.76E-03	2.19E-03	9.58E-03
Indeno(1,2,3-cd)pyrene	1.76E-09	2.19E-09	9.58E-09
Naphthalene	5.98E-07	7.42E-07	3.25E-06
Phenanthrene	1.67E-08	2.07E-08	9.05E-08
Pyrene	4.90E-09	6.08E-09	2.66E-08
Toluene	3.33E-06	4.13E-06	1.81E-05
Total HAP		2.29E-03	1.00E-02

Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

Northern Natural Gas Company - Clarion Compressor Station
Natural Gas Fired Space Heaters

Heating Characteristics of Space Heaters

	Unit Rating (MMBtu/hr)	Location
Heater 1	0.060	Compressor Building
Heater 2	0.060	
Heater 3	0.060	
Heater 4	0.060	
Heater 5	0.060	
Heater 6	0.060	Auxiliary Building
Heater 7	0.060	
Total	**0.420**	

Heat Value: 1,020 BTU/cf

Existing Space Heaters

Pollutant	Emission Factor (lb/MMBtu)	Emission Rate (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
PM	7.45E-03	3.13E-03	0.014
PM_{10}	7.45E-03	3.13E-03	0.014
$PM_{2.5}$	7.45E-03	3.13E-03	0.014
SO_2	5.88E-04	2.47E-04	0.001
CO_2[2]	116.98	4.91E+01	215.19
CH_4[2]	2.20E-03	9.26E-04	4.06E-03
N_2O[2]	2.20E-04	9.26E-05	4.06E-04
CO_2e[2]	117.10	4.92E+01	215.41
NO_x	9.22E-02	3.87E-02	0.170
VOC	5.39E-03	2.26E-03	0.010
CO	3.92E-02	1.65E-02	0.072

[1]Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

[2] Emission factors based on 40 CFR 98 Subpart C

HAP Emissions

Pollutant	Emission Factor (lb/MMBtu)	Maximum Uncontrolled Emissions (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)
2-Methylnaphthalene	2.35E-08	9.88E-09	4.33E-08
3-Methylchloranthrene	1.76E-09	7.41E-10	3.25E-09
7,12-Dibethylbenz(a)anthracene	1.57E-08	6.59E-09	2.89E-08
Acenaphthene	1.76E-09	7.41E-10	3.25E-09
Acenaphthylene	1.76E-09	7.41E-10	3.25E-09
Anthracene	2.35E-09	9.88E-10	4.33E-09
Benz(a)anthracene	1.76E-09	7.41E-10	3.25E-09
Benzene	2.06E-06	8.65E-07	3.79E-06
Benzo(a)pyrene	1.18E-09	4.94E-10	2.16E-09
Benzo(b)fluoranthene	1.76E-09	7.41E-10	3.25E-09
Benzo(b,h,i)perylene	1.18E-09	4.94E-10	2.16E-09
Benzo(k)fluoranthene	1.76E-09	7.41E-10	3.25E-09
Chrysene	1.76E-09	7.41E-10	3.25E-09
Dibenzo(a,h)anthracene	1.18E-09	4.94E-10	2.16E-09
Dichlorobenzene	1.18E-06	4.94E-07	2.16E-06
Fluoranthene	2.94E-09	1.24E-09	5.41E-09
Fluorene	2.75E-09	1.15E-09	5.05E-09
Formaldehyde	7.35E-05	3.09E-05	1.35E-04
Hexane	1.76E-03	7.41E-04	3.25E-03
Indeno(1,2,3-cd)pyrene	1.76E-09	7.41E-10	3.25E-09
Naphthalene	5.98E-07	2.51E-07	1.10E-06
Phenanthrene	1.67E-08	7.00E-09	3.07E-08
Pyrene	4.90E-09	2.06E-09	9.02E-09
Toluene	3.33E-06	1.40E-06	6.13E-06
Total HAP		7.75E-04	3.39E-03

Emission factors based on AP-42, Fifth Edition, Section 1.4 "Natural Gas Combustion," 7/98

Note: Space heaters are defined as those not connected to piping or ducting to distribute heat.

Northern Natural Gas Company - Clarion Compressor Station
Fugitive Emissions from Leaks

Component Type	EU#	Type of Service [1]	Number of Components [1]	Emission Factors (lb/hr-component) [2]	Percent VOC [3]	Percent CH4 [3]	Percent CO2 [3]	Potential VOC Emission Rates [4]		Potential CH4 Emission Rates [4]		Potential CO2 Emission Rates [4]		Potential CO2e Emission Rates [4]	
								(lb/hr)	(ton/yr)	(lb/hr)	(T/yr)	(lb/hr)	(T/yr)	(lb/hr)	(T/yr)
Valves	EU3	Gas/Vapor	253	0.00992	0.68%	86.78%	0.86%	0.02	0.08	2.18	9.54	0.02	0.09	61.01	267.21
Flanges	EU3	Gas/Vapor	94	0.00086	0.68%	86.78%	0.86%	0.001	0.002	0.07	0.31	0.001	0.003	1.96	8.60
Compressor Seals	EU3	Gas/Vapor	31	0.01940	0.68%	86.78%	0.86%	0.004	0.02	0.52	2.29	0.01	0.02	14.62	64.03
Relief Valves	EU3	Gas/Vapor	20	0.01940	0.68%	86.78%	0.86%	0.003	0.01	0.34	1.47	0.003	0.01	9.43	41.31
Totals:		---	**398**	---	---	---	---	**0.0246**	**0.110**	**3.110**	**13.610**	**0.030**	**0.120**	**87.020**	**381.150**

Conversion kg to lb: 2.204623

Notes:

1. Number of each component and type of service estimated based on preliminary design documents.
2. Emission factors based on Table 2-4 'Oil and Gas Production Operations Average Emission Factors' from 'Protocol for Equipment Leak Emission Estimates' (EPA-453/R-95-017 - November 1995).
3. Percent VOC for Gas/Vapor service based on gas analysis from representative facility (refer to Attachment 4, Table 2).
4. Emission rates based on 8,760 hours of operation per year.

			Total Fugitive VOC/HAP Uncontrolled Emissions	
Pollutant		**Wt% [1]**	**(lb/hr)**	**(T/yr)**
Benzene		0.00%	0.0000	0.0000
Toluene		0.00%	0.0000	0.0000
Ethylbenzene		0.00%	0.0000	0.0000
Xylenes		0.00%	0.0000	0.0000
n-Hexane		0.00%	0.0000	0.0000
Total HAPs		**0.00%**	**0.0000**	**0.0000**
Total VOCs		**0.685%**	**0.02**	**0.11**

**Based on Gas Analyses, which shows other hexanes to be 0%.

Fugitive Emissions from Venting

Facility	Volume	Emissions						
		CH4		CO2		CO2e	VOC	HAP
	(scf/yr)	scf/year	ton/year	scf/year	ton/year	ton/year	ton/year	ton/year
Compressor Station Blowdown	606,500	526,297	11.14	5,191	0.30	312.19	0.09	0.00
Compressor Unit Blowdown	1,045,000	906,809	19.19	8,944	0.52	537.90	0.15	0.00
Total		--	**30.33**	--	**0.82**	**850.08**	**0.24**	**0.00**

Gas Composition:	86.78%	CH_4	
	0.86%	$CO_{2\ [1]}$	
Density from 40 CFR 98.233(v)	0.0192	kg/scf	CH_4
	0.0526	kg/scf	CO_2
Conversion Factor	2.20462	lb/kg	
	2000	lb/ton	
GWP per 40 CFR 98 Subpart A	28	lb CO_2e/lb CH_4	
Ratio of VOC to CH4	0.008	(by mass)[1]	
Ratio of HAP to CH4	0.000	(by mass)[1]	

[1] Data From GC3800