Northern Border Pipeline Company

Operated by TransCanada

MAY 2016
Received
Air Quality

April 30, 2016

UPS No. 1Z 40V 7E7 37 1001 561

North Dakota Department of Health
Division of Air Quality
918 East Divide Avenue
Bismarck, North Dakota 58501 – 1947

RE: Northern Border Compressor Station No. 8 – McIntosh County T5-O84002
Title V Renewal Application

Dear Sir or Madam:

Enclosed please find Attachment 1, a Title V renewal application for Northern Border Pipeline Company's Compressor Station No. 8. Attachment 2 shows the site potential-to emit calculations for both criteria and greenhouse gas pollutants. The only change from the previous submittal is the heat content of the natural gas which has increased from 1007 Btu/Scf to 1061 Btu/Scf. This change only impacts the boiler emissions which are reduced slightly with this change because the emission factors are based on pounds/MMScf rather than pounds/MMBtu. There are no known new applicable requirements for this facility since the last submittal.

No changes are being requested to the existing permit so a copy of the permit is not being submitted with this application.

For all questions, please contact me at (402) 492 – 7465.

Sincerely,

Ruth Jensen

Ruth Jensen
Environmental Specialist

Cc: Compressor Station No. 8 (Section 2)

Air Programs (8P-AR) UPS No. 1Z 40V 7E7 37 1001 562 0
Office of Partnerships & Regulatory Assistance
U.S. EPA, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Attachment 1

NORTH DAKOTA DEPARTMENT OF HEALTH
TITLE V PERMIT TO OPERATE - RENEWAL APPLICATION
Division of Air Quality
SFN52824 (5-11)

In accordance with 33-15-14-04.c. of the North Dakota Air Pollution Control Rules, a Title V permit renewal application must be submitted to the Department at least six months, but no more than eighteen months, prior to the expiration date. Permit renewal applications are incomplete unless all information requested herein is supplied. The current Title V permit will be the baseline reference for this renewal. The requirements (40 CFR 70.5(c) & NDAC 33-15-14-06.4.c) to include a citation and description of all applicable requirements and a description of or reference to any applicable test method for determining compliance with each applicable requirement may be met by accomplishing either or both of the following: 1) enclose an annotated (red-lined) copy of the current permit indicating all changes needed to reflect the current facility configuration, applicable requirements and test methods; 2) enclose a narrative that conveys all changes needed to the current permit to reflect the current facility configuration, all applicable requirements and test methods.

FOR ACID RAIN UNITS ONLY – Submit with the Title V permit renewal application all Acid Rain renewal applications (the Acid Rain Permit Application, the Phase II NO_x Compliance Plan, and if applicable, the Phase II NO_x Averaging Plan).

PART 1. GENERAL APPLICATION INFORMATION

Owner's Name Northern Border Pipeline Company

Facility Name Compressor Station No. 8 (Zeeland)

Name of Person Completing Application Ruth Jensen Phone 402-492-7465

Title Environmental Specialist Email ruth_jensen@transcanada.com

Current Operating Permit Number T5-O84002

Expiration Date of Current Operating Permit 12 / 31 / 2016

PART 2. COMPLIANCE CERTIFICATION

A. Schedule for Submission of Compliance Certifications During the Term of the Permit

Frequency of Submittal	Date Beginning (month/day/year)
Annual	2/14/2012

B. Statement of Compliance with Compliance Assurance Monitoring (CAM) and Compliance Certification Requirements

The facility identified in this application is in compliance with applicable monitoring and compliance certification requirements.

- ☐ Yes
- ☐ No - Describe below which requirements are not being met:
- ☑ CAM not applicable

C. Certification of Compliance with all Applicable Requirements

This certification must be signed by a "responsible official" as defined in NDAC 33-15-14-06.1. Forms without a signed certification will be returned as incomplete.

Except for requirements identified in Compliance Schedule and Plan (Section G) of Title V Permit to Operate application forms for which compliance is not achieved, I hereby certify that, based on information and belief formed after reasonable inquiry, the air contaminant source identified in this form is in compliance with all applicable requirements.

Signed	Date April 30, 2016
Typed Name Rick Duncan	

PART 3. STATUS OF SOURCE

Has there been any change to the source, applicable requirements or test methods since the most recent initial or renewal permit application, minor permit modification, significant modification or administrative permit amendment?

☑ No ☐ Yes

If yes, complete and submit appropriate sections of Title V Permit to Operate application forms.

PART 4. CERTIFICATION OF TRUTH, ACCURACY AND COMPLETENESS

Note: This certification must be signed by a "responsible official" as defined in NDAC 33-15-14-06.1. Applications without a signed certification will be returned as incomplete.

I certify under penalty of law that, based on information and belief formed after reasonable inquiry, the statements and information contained in this application are true, accurate and complete.

Name (typed) Rick Duncan

(Signed) _____ Date 04 / 30 / 2016

Telephone Number (402) 492-7455

Send original renewal application to:

ND Department of Health
Division of Air Quality
918 E. Divide, 2nd Floor
Bismarck, ND 58501-1947

Send copy of renewal application to:

Air Program (8P-AR)
Office of Partnerships & Regulatory Assistance
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Attachment 2

Typical NBPL Gas Composition VOC Content

Calculate MW and BTU Content of Fuel Gas

	mole %	MW	lb/mole	BTU/Scf HHV	BTU/Scf LHV	wt%	VOC wt%
C1	89.4609	16.043	14.35221219	905.6126907	813.2890419	81.12732745	
C2	7.3679	30.069	2.215453851	130.6918102	119.1978862	12.52307642	
C3	0.7086	44.096	0.312464256	17.870892	16.4104674	1.766235733	1.766235733
iC4	0.0380	58.123	0.02208674	1.238572	1.14038	0.124847526	0.124847526
nC4	0.0499	58.123	0.029003377	1.6316801	1.5022395	0.163944515	0.163944515
iC5	0.0082	72.151	0.005916382	0.3288364	0.3032278	0.033442946	0.033442946
nC5	0.0061	72.151	0.004401211	0.245098	0.2261148	0.024878289	0.024878289
C6+	0.0040	86.178	0.00344712	0.205648	0.176156	0.019485194	0.019485194
N2	1.3462	28.013	0.377111006	0	0	2.13165801	
CO2	0.8307	44.01	0.36559107	0	0	2.066540409	
H2	0.1629	2.016	0.003284064	0.52804035	0.44610165	0.018563503	
He	0.0178	4	0.000712	0	0	0.004024652	
	100.00		17.69097126	1058.353268	952.6916153	100	2.132834203
			AGA Real Heating Value	**1061.11557**			

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
Site Greenhouse Gas Pollutant Potential-To-Emit Summary

Site Greenhouse Gas Pollutant Emission Summary							
Unit	CO_2 (tpy)	CO_2e (tpy)	Methane (tpy)	CO_2e (tpy)	N_2O (tpy)	CO_2e (tpy)	Total CO_2e (tpy)
CE1	162,809	162,809	11.67	245.11	2.76	854.93	163,909
EG1	2,555	2,555	5.03	105.57	0.00	1.49	2,662
HE1 + HE2	1,367	1,367	0.02	0.49	0.02	7.18	1,375
TOTAL	**166,731**	**166,731**	**16.72**	**351.16**	**2.79**	**863.59**	**167,946**

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
CE1 Greenhouse Gas Pollutant Calculations

Emission Unit ID: CE1
Description: Cooper-Rolls Coberra 6562-DLE Compressor Turbine
Rating: 38,000 horsepower (ISO)
Max. Heat Input: 318 million British thermal units per hour (MMBtu/hr)
Fuel Type: Natural Gas
Controls: Dry low NOx combustion
Conversion: 2,000 lb/ton
Conversion: 8,760 hours per year

Pollutant	Emission Factor[a]	Emission Factor Units	Global Warming Potential	Emissions		
				(lb/hr)	(ton/yr)	(ton/yr CO_2e[b])
CO_2	116.9	lb/MMBtu	1	37,171.0	162,809	162,809
Methane	8.38E-03	lb/MMBtu	21	2.66	11.672	245.112
N_2O	1.98E-03	lb/MMBtu	310	0.63	2.758	854.925

[a] CO_2 emission factor based on Table C-1 to Subpart C of 40 CFR 98 and
CH_4 and N_2O emission factors are based on Table 12-7 of the Climate Registry Default Emission Factors.
[b] Global warming potential or CO_2e is based on Table A-1 to Subpart A of 40 CFR 98.

Example calculations:

CO_2 ton/yr: (116.9 lb/MMBtu) * (318 MMBtu/hr)*(8,760hours/year / (2,000 lb/ton) = 162,809 ton/yr CO2

CO_2e ton/yr: (162,809 ton/yr) * (1 GWP) = 162,809 ton/yr CO2e

Methane ton/yr: (0.00838 lb/MMBtu) * (318 MMBtu/hr)*(8,760hours/year / (2,000 lb/ton) = 11.672 ton/yr Methane

CO_2e ton/yr: (11.672 ton/yr) * (21 GWP) = 245.112 ton/yr CO2e

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
EG1 Greenhouse Gas Pollutant Calculations

Emission Unit ID:	EG1	
Description:	Waukesha L-3711 GU	
Rating:		kilowatts (kW)
Rating:	550	horsepower
Max. Heat Input:	4.99	million British thermal units per hour (MMBtu/hr)
Fuel Type:	Natural Gas	
Controls:	None	
Conversion:	2,000	lb/ton
Conversion:	500	hours per year

Pollutant	Emission Factor[a]	Emission Factor Units	Global Warming Potential	Emissions		
				(lb/hr)	(ton/yr)	(ton/yr CO_2e[b])
CO_2	116.9	lb/MMBtu	1	583.3	2,555	2,555
Methane	2.30E-01	lb/MMBtu	21	1.15	5.027	105.565
N_2O	2.20E-04	lb/MMBtu	310	0.00	0.005	1.491

[a] CO_2 emission factor based on Table C-1 to Subpart C of 40 CFR 98 and
N_2O emission factor is based on Table C-2 to Subpart C of 40 CFR 98 and
Methane emission factor is based on Table 12.7 of the Climate Registry Default Emission Factors.
[b] Global warming potential or CO_2e is based on Table A-1 to Subpart A of 40 CFR 98.

Example calculations:

CO_2 ton/yr: (116.9 lb/MMBtu) * (5 MMBtu/hr)*(500hours/year / (2,000 lb/ton) = 2,555 ton/yr CO2

CO_2e ton/yr: (2,555 ton/yr) * (1 GWP) = 2,555 ton/yr CO2e

Methane ton/yr: (0.23000 lb/MMBtu) * (5 MMBtu/hr)*(500hours/year / (2,000 lb/ton) = 5.027 ton/yr Methane

CO_2e ton/yr: (5.027 ton/yr) * (21 GWP) = 105.565 ton/yr CO2e

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
HE1 and HE2 Greenhouse Gas Pollutant Calculations

Emission Unit ID: HE1 and HE2 (HE1 and HE2 are insignificant activities.)
Description: Hydronic Boiler
Max. Heat Input: 2.670 million British thermal units per hour (MMBtu/hr)
Fuel Type: Natural Gas
Controls: None
Conversion: 2,000 lb/ton
Conversion: 8,760 hours per year

Pollutant	Emission Factor[a]	Emission Factor Units	Global Warming Potential	Emissions		
				(lb/hr)	(ton/yr)	(ton/yr CO_2e[b])
CO_2	116.9	lb/MMBtu	1	312.1	1,367	1,367
Methane	1.98E-03	lb/MMBtu	21	0.01	0.023	0.486
N_2O	1.98E-03	lb/MMBtu	310	0.01	0.023	7.178

[a] CO_2 emission factor based on Table C-1 to Subpart C of 40 CFR 98 and
CH_4 and N_2O emission factors are based on Table 12.7 of Climate Registry Default Emission Factors.
[b] Global warming potential or CO_2e is based on Table A-1 to Subpart A of 40 CFR 98.

Example calculations:

CO_2 ton/yr: (116.9 lb/MMBtu) * (3 MMBtu/hr)*(8,760hours/year / (2,000 lb/ton) = 1,367 ton/yr CO2

CO_2e ton/yr: (1,367 ton/yr) * (1 GWP) = 1,367 ton/yr CO2e

Methane ton/yr: (0.00198 lb/MMBtu) * (3 MMBtu/hr)*(8,760hours/year / (2,000 lb/ton) = 0.023 ton/yr Methane

CO_2e ton/yr: (0.023 ton/yr) * (21 GWP) = 0.486 ton/yr CO2e

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
Site Criteria Pollutant Potential-To-Emit Summary

Site Criteria Pollutant Emission Summary										
Unit	**NOX (lb/hr)**	**NOX (tpy)**	**CO (lb/hr)**	**CO (tpy)**	**VOC (lb/hr)**	**VOC (tpy)**	**PM10 (lb/hr)**	**PM10 (tpy)**	**SO2 (lb/hr)**	**SO2 (tpy)**
CE1	*	234.18	22.40	98.11	3.00	13.14	2.10	9.19	2.09	9.16
EG1	11.03	2.76	18.56	4.64	0.15	0.04	0.10	0.02	0.003	0.0007
HE1 + HE2	0.25	1.10	0.21	0.93	0.01	0.06	0.02	0.08	0.002	0.007
TOTAL		**238.04**		**103.68**		**13.24**		**9.30**		**9.17**

*51.5 lb/hr in DLE and 78 lb/hr in non-DLE

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
Site Hazardous Air Pollutant Potential-To-Emit Summary

Pollutant	CAS Number	CE1 (ton/yr)	EG1 (ton/yr)	HE1 + HE2 (ton/yr)	Total (ton/yr)
Acenaphthene	83-32-9	-	-	1.98E-08	**1.98E-08**
Acenaphthylene	208-96-8	-	-	1.98E-08	**1.98E-08**
Acetaldehyde	75-07-0	5.57E-02	3.48E-03	-	**5.92E-02**
Acrolein	107-02-8	8.91E-03	3.28E-03	-	**1.22E-02**
Anthracene	120-12-7	-	-	2.65E-08	**2.65E-08**
Arsenic	7440-38-2	-	-	2.20E-06	**2.20E-06**
Benzene	71-43-2	1.67E-02	1.97E-03	2.31E-05	**1.87E-02**
Benzo(a)anthracene	56-55-3	4.18E-03	-	1.98E-08	**4.18E-03**
Benzo(a)pyrene	50-32-8	-	-	1.32E-08	**1.32E-08**
Benzo(b)fluoranthene	205-99-2	-	-	1.98E-08	**1.98E-08**
Benzo(e)pyrene	192-97-2	-	-	-	**-**
Benzo(g,h,i)perylene	191-24-2	-	-	1.32E-08	**1.32E-08**
Benzo(k)fluoranthene	207-08-9	-	-	1.98E-08	**1.98E-08**
Beryllium	7440-41-7	-	-	1.32E-07	**1.32E-07**
Biphenyl	92-52-4	-	-	-	**-**
1,3-Butadiene	106-99-0	5.99E-04	8.27E-04	-	**1.43E-03**
Cadmium	7440-43-9	9.64E-03	-	1.21E-05	**9.65E-03**
Carbon Tetrachloride	56-23-5	-	2.21E-05	-	**2.21E-05**
Chlorobenzene	108-90-7	-	1.61E-05	-	**1.61E-05**
Chloroform	67-66-3	-	1.71E-05	-	**1.71E-05**
Chromium	7440-47-3	1.84E-02	-	1.54E-05	**1.84E-02**
Chrysene	218-01-9	-	-	1.98E-08	**1.98E-08**
Cobalt	7440-48-4	-	-	9.26E-07	**9.26E-07**
Dibenzo(a,h)anthracene	53-70-3	-	-	1.32E-08	**1.32E-08**
Dichlorobenzene	106-46-7	-	-	1.32E-05	**1.32E-05**
7,12-Dimethylbenz(a)anthracene	57-97-6	-	-	1.76E-07	**1.76E-07**
1,3-Dichloropropene	542-75-6	-	1.58E-05	-	**1.58E-05**
Ethylbenzene	100-41-4	4.46E-02	3.09E-05	-	**4.46E-02**
Ethylene Dibromide	106-93-4	-	2.66E-05	-	**2.66E-05**
Fluoranthene	206-44-0	1.67E-03	-	3.31E-08	**1.67E-03**
Fluorene	86-73-7	-	-	3.09E-08	**3.09E-08**
Formaldehyde	50-00-0	9.89E-01	2.56E-02	8.27E-04	**1.02E+00**
Indeno(1,2,3-c,d)pyrene	193-39-5	-	-	1.98E-08	**1.98E-08**
Manganese	7439-96-5	1.12E-01	-	4.19E-06	**1.12E-01**
Mercury	7439-97-6	9.23E-03	-	2.87E-06	**9.24E-03**
Methanol	67-56-1	-	3.82E-03	-	**3.82E-03**
Methylene Chloride	75-09-2	-	5.14E-05	-	**5.14E-05**
2-Methylnaphthalene	91-57-6	-	-	2.65E-07	**2.65E-07**
3-Methylchloranthrene	56-49-5	-	-	1.98E-08	**1.98E-08**
n-Hexane	110-54-3	-	-	1.98E-02	**1.98E-02**
Naphthalene	91-20-3	1.81E-03	1.21E-04	6.72E-06	**1.94E-03**
Nickel	7440-02-0	1.60E-01	-	2.31E-05	**1.60E-01**
PAH	NA	3.06E-03	1.76E-04	-	**3.24E-03**
Phenanthrene	85-01-8	-	-	1.87E-07	**1.87E-07**
Phenol	108-95-2	1.77E-02	-	-	**1.77E-02**
Propylene	115-07-1	-	-	-	**-**
Pyrene	129-00-0	-	-	5.51E-08	**5.51E-08**
Perylene	198-55-0	-	-	-	**-**
Propylene Oxide	198-55-0	4.04E-02	-	-	**4.04E-02**
Selenium	7782-49-2	-	-	2.65E-07	**2.65E-07**
Styrene	100-42-5	-	1.48E-05	-	**1.48E-05**
Toluene	108-88-3	1.81E-01	6.96E-04	3.75E-05	**1.82E-01**
Tetrachloroethane	79-34-5	-	-	-	**-**
1,1,2,2-Tetrachloroethane	79-34-5	-	3.16E-05	-	**3.16E-05**
1,1,2-Trichloroethane	79-00-5	-	1.91E-05	-	**1.91E-05**
2,2,4-Trimethylpentane	540-84-1	-	-	-	**-**
Vinyl Chloride	75-01-4	-	8.96E-06	-	**8.96E-06**
Xylene	108-38-3	8.91E-02	2.43E-04	-	**8.94E-02**
Total		**1.764**	**0.0404**	**0.0208**	**1.82**

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
CE1 Criteria and Hazardous Air Pollutant Calculations

Emission Unit ID: CE1
Description: Cooper-Rolls Coberra 6562-DLE Compressor Turbine
Rating: 38,000 horsepower (ISO)
Max. Heat Input: 318 million British thermal units per hour (MMBtu/hr)
Fuel Type: Natural Gas
Controls: Dry low NOx combustion
Wt% Sulfur: 0.007 2.0 grains per 100 scf = 0.007 Weight Percent
Conversion: 2,000 lb/ton
Conversion: 8,760 hours per year
650 hours per year non-DLE operation
8,110 hours per year DLE operation

Pollutant	Emission Factor	Emission Factor Units	Emissions (lb/hr)	Emissions (ton/yr)
NOx (DLE)	51.5	lb/hr	51.5	209
NOx (non-DLE)	78.0	lb/hr	78.0	25
CO	22.4	lb/hr	22.4	98
VOC	3.0	lb/hr	3.0	13
PM10	0.0066	lb/MMBtu	2.1	9.2
SO2	0.0066	lb/MMBtu	2.1	9.2
HAP[a]				
Acetaldehyde	4.00E-05	lb/MMBtu	1.27E-02	5.57E-02
Acrolein	6.40E-06	lb/MMBtu	2.04E-03	8.91E-03
Benzene	1.20E-05	lb/MMBtu	3.82E-03	1.67E-02
Benzo(a)anthracene	3.00E-06	lb/MMBtu	9.54E-04	4.18E-03
1,3-Butadiene	4.30E-07	lb/MMBtu	1.37E-04	5.99E-04
Cadmium	6.92E-06	lb/MMBtu	2.20E-03	9.64E-03
Chromium	1.32E-05	lb/MMBtu	4.20E-03	1.84E-02
Ethylbenzene	3.20E-05	lb/MMBtu	1.02E-02	4.46E-02
Fluoranthene	1.20E-06	lb/MMBtu	3.82E-04	1.67E-03
Formaldehyde	7.10E-04	lb/MMBtu	2.26E-01	9.89E-01
Manganese	8.02E-05	lb/MMBtu	2.55E-02	1.12E-01
Mercury	6.63E-06	lb/MMBtu	2.11E-03	9.23E-03
Naphthalene	1.30E-06	lb/MMBtu	4.13E-04	1.81E-03
Nickel	1.15E-04	lb/MMBtu	3.66E-02	1.60E-01
Phenol	1.27E-05	lb/MMBtu	4.04E-03	1.77E-02
PAH	2.20E-06	lb/MMBtu	7.00E-04	3.06E-03
Propylene Oxide	2.90E-05	lb/MMBtu	9.22E-03	4.04E-02
Toluene	1.30E-04	lb/MMBtu	4.13E-02	1.81E-01
Xylene	6.40E-05	lb/MMBtu	2.04E-02	8.91E-02
Total HAP			**0.40**	**1.764**

NOx, CO, and VOC factors are based on manufacturer's data.
SO2 and PM10 emission factors are based on AP-42, Table 3.1-2a (April 2000).
(PM10 factor has been updated from previous application.)

[a] HAP emission factors based on AP-42, Table 3.1-3 (April 2000) for natural gas-fired turbines and EPA FIRE Database (Version 6.23).

Example calculations:

NOx ton/yr: (51.5 lb/hr) * (8,110 hr/yr) / (2,000 lb/ton) = 209 ton/yr NOx
CO ton/yr: (22.4 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 98 ton/yr CO
VOC ton/yr: (3.0 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 13 ton/yr VOC
PM10 lb/hr: (0.0066 lb/MMBtu) * (318 MMBtu/hr) = 2.1 lb/hr PM10
PM10 ton/year: (2.1 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 9.2 ton/yr PM10
SO2 lb/MMBtu: (0.0070 wt% S) * (0.94) = 0.0066 lb/MMBtu SO2
SO2 lb/hr: (0.007 lb/MMBtu) * (318 MMBtu/hr) = 2.1 lb/hr SO2
SO2 ton/yr: (2.1 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 9.2 ton/yr SO2
Acrolein lb/hr: (0.0000064 lb/MMBtu) * (318 MMBtu/hr) = 0.002 lb/hr Acrolein
Acrolein ton/yr: (0.002 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.01 ton/yr Acrolein

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
EG1 Criteria Pollutant Calculations

Emission Unit ID: EG1
Description: Waukesha L-3711 GU
Rating: kilowatts (kW)
Rating: 550 horsepower
Heat Input: 8,250 British thermal units per horsepower-hour (Btu/hp-hr)
Heat Input: 4.99 million British thermal units per hour (MMBtu/hr)
Fuel Type: Natural Gas
Controls: None
Conversion: 2,000 lb/ton
Conversion: 500 hours per year

Pollutant	Emission Factor	Emission Factor Units	(lb/hr)	(ton/yr)
NOx	2.21	lb/MMBtu	11.03	2.76
CO	3.720	lb/MMBtu	18.56	4.64
VOC	2.96E-02	lb/MMBtu	0.15	0.04
PM10	1.94E-02	lb/MMBtu	0.10	0.02
SO2	5.88E-04	lb/MMBtu	0.003	0.0007

Note: The criteria pollutant emission factors are based on AP-42, Table 3.2-3 (July 2000). The PM10 emission factor includes filterable plus condensable PM.

Example calculations:

NOx lb/hr: (4.99 MMBtu/hr) * (2.21 lb/MMBtu) = 11.03 lb/hr NOx

NOx ton/yr: (11.0 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 2.76 ton/yr NOx

CO lb/hr: (4.99 MMBtu/hr) * (3.720 lb/MMBtu) = 18.56 lb/hr CO

CO ton/yr: (18.56 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 4.64 ton/yr CO

VOC lb/hr: (4.99 MMBtu/hr) * (0.0296 lb/MMBtu) = 0.15 lb/hr VOC

VOC ton/yr: (0.15 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 0.04 ton/yr VOC

PM10 lb/hr: (4.99 MMBtu/hr) * (0.0194 lb/MMBtu) = 0.10 lb/hr PM10

PM10 ton/yr: (0.10 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 0.02 ton/yr PM10

SO2 lb/hr: (4.99 MMBtu/hr) * (0.0006 lb/MMBtu) = 0.003 lb/hr SO2

SO2 ton/yr: (0.003 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 0.0007 ton/yr SO2

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
EG1 Hazardous Air Pollutant Calculations

Emission Unit ID: EG1
Description: Waukesha L-3711 GU
Rating: kilowatts (kW)
Rating: 550 horsepower
Heat Input: 8,250 British thermal units per horsepower-hour (Btu/hp-hr)
Heat Input: 4.99 million British thermal units per hour (MMBtu/hr)
Fuel Type: Natural Gas
Controls: None
Conversion: 2,000 lb/ton
Conversion: 500 hours per year

Pollutant	CAS Number	Emission Factor	Emission Factor Units	Emissions (lb/hr)	Emissions (ton/yr)
Acenaphthene	83-32-9	-	-	-	-
Acenaphthylene	208-96-8	-	-	-	-
Acetaldehyde	75-07-0	2.79E-03	lb/MMBtu	1.39E-02	3.48E-03
Acrolein	107-02-8	2.63E-03	lb/MMBtu	1.31E-02	3.28E-03
Anthracene	120-12-7	-	-	-	-
Arsenic	7440-38-2	-	-	-	-
Benzene	71-43-2	1.58E-03	lb/MMBtu	7.88E-03	1.97E-03
Benzo(a)anthracene	56-55-3	-	-	-	-
Benzo(a)pyrene	50-32-8	-	-	-	-
Benzo(b)fluoranthene	205-99-2	-	-	-	-
Benzo(e)pyrene	192-97-2	-	-	-	-
Benzo(g,h,i)perylene	191-24-2	-	-	-	-
Benzo(k)fluoranthene	207-08-9	-	-	-	-
Beryllium	7440-41-7	-	-	-	-
Biphenyl	92-52-4	-	-	-	-
1,3-Butadiene	106-99-0	6.63E-04	lb/MMBtu	3.31E-03	8.27E-04
Cadmium	7440-43-9	-	-	-	-
Carbon Tetrachloride	56-23-5	1.77E-05	lb/MMBtu	8.83E-05	2.21E-05
Chlorobenzene	108-90-7	1.29E-05	lb/MMBtu	6.44E-05	1.61E-05
Chloroform	67-66-3	1.37E-05	lb/MMBtu	6.84E-05	1.71E-05
Chromium	7440-47-3	-	-	-	-
Chrysene	218-01-9	-	-	-	-
Cobalt	7440-48-4	-	-	-	-
Copper	7440-48-4	-	-	-	-
1,3-Dichloropropene	53-70-3	1.27E-05	lb/MMBtu	6.34E-05	1.58E-05
Dibenzo(a,h)anthracene	106-46-7	-	-	-	-
Dichlorobenzene	57-97-6	-	-	-	-
7,12-Dimethylbenz(a)anthracene	542-75-6	-	-	-	-
Ethylbenzene	100-41-4	2.48E-05	lb/MMBtu	1.24E-04	3.09E-05
Ethylene Dibromide	106-93-4	2.13E-05	lb/MMBtu	1.06E-04	2.66E-05
Fluoranthene	206-44-0	-	-	-	-
Fluorene	86-73-7	-	-	-	-
Formaldehyde	50-00-0	2.05E-02	lb/MMBtu	1.02E-01	2.56E-02
Indeno(1,2,3-c,d)pyrene	193-39-5	-	-	-	-
Manganese	7439-96-5	-	-	-	-
Mercury	7439-97-6	-	-	-	-
Methanol	67-56-1	3.06E-03	lb/MMBtu	1.53E-02	3.82E-03
Methylene Chloride	75-09-2	4.12E-05	lb/MMBtu	2.06E-04	5.14E-05
2-Methylnaphthalene	91-57-6	-	-	-	-
3-Methylchloranthrene	56-49-5	-	-	-	-
n-Hexane	110-54-3	-	-	-	-
Naphthalene	91-20-3	9.71E-05	lb/MMBtu	4.85E-04	1.21E-04
Nickel	7440-02-0	-	-	-	-
Phenol	108-95-2	-	-	-	-
PAH	85-01-8	1.41E-04	lb/MMBtu	7.04E-04	1.76E-04
Perylene	108-95-2	-	-	-	-
Phenanthrene	115-07-1	-	-	-	-
Propylene	129-00-0	-	-	-	-
Propylene Oxide	198-55-0	-	-	-	-
Pyrene	198-55-0	-	-	-	-
Selenium	7782-49-2	-	-	-	-
Styrene	100-42-5	1.19E-05	lb/MMBtu	5.94E-05	1.48E-05
Toluene	108-88-3	5.58E-04	lb/MMBtu	2.78E-03	6.96E-04
Tetrachloroethane	79-34-5	-	-	-	-
1,1,2,2-Tetrachloroethane	79-34-5	2.53E-05	lb/MMBtu	1.26E-04	3.16E-05
1,1,2-Trichloroethane	79-00-5	1.53E-05	lb/MMBtu	7.63E-05	1.91E-05
2,2,4-Trimethylpentane	540-84-1	-	-	-	-
Vinyl Chloride	75-01-4	7.18E-06	lb/MMBtu	3.58E-05	8.96E-06
Xylene	108-38-3	1.95E-04	lb/MMBtu	9.73E-04	2.43E-04
Total HAPs				**0.16**	**0.0404**

The emission factors are based on AP-42, *Uncontrolled Emission Factors for 4-Stroke Rich Burn Engines*, Table 3.2-3 (July 2000).

Example calculations:

Acetaldehyde lb/hr: (0.00279 lb/MMBtu) * (4.99 MMBtu/hr) = 0.01 lb/hr Acetaldehyde

Acetaldehyde ton/yr: (0.01 lb/hr) * (500 hr/yr) / (2,000 lb/ton) = 0.003 ton/yr Acetaldehyde

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
HE1 and HE2 Criteria Pollutant Calculations

Emission Unit ID: HE1 and HE2 (HE1 and HE2 are insignificant activities.)
Description: Heaters
Max. Heat Input: 2.67 million British thermal units per hour (MMBtu/hr)
Heating Value: 1,061 British thermal units per standard cubic foot (Btu/scf)
Fuel Usage: 0.0025 million standard cubic feet per hour (MMscf/hr)
Fuel Type: Natural Gas
Controls: None
Conversion: 2,000 lb/ton
Conversion: 8,760 hours per year

Pollutant	Emission Factor	Emission Factor Units	(lb/hr)	(ton/yr)
NOx	100.0	lb/MMscf	0.25	1.10
CO	84.0	lb/MMscf	0.21	0.93
VOC	5.5	lb/MMscf	0.01	0.06
PM10	7.6	lb/MMscf	0.02	0.08
SO2	0.6	lb/MMscf	0.002	0.007

The emission factors are based on AP-42, *Emission Factors for Criteria Pollutant and Greenhouse Gases From Natural Gas Combustion*, Tables 1.4-1 and 2 (July 1998).

Example calculations:

NOx lb/hr: (0.0025 MMscf/hr) * (100 lb/MMscf) = 0.25 lb/hr NOx

NOx ton/yr: (0.3 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 1.10 ton/yr NOx

CO lb/hr: (0.0025 MMscf/hr) * (84 lb/MMscf) = 0.21 lb/hr CO

CO ton/yr: (0.21 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.93 ton/yr CO

VOC lb/hr: (0.0025 MMscf/hr) * (5.5 lb/MMscf) = 0.01 lb/hr CO

VOC ton/yr: (0.01 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.06 ton/yr VOC

PM10 lb/hr: (0.0025 MMscf/hr) * (7.6 lb/MMscf) = 0.02 lb/hr PM10

PM10 ton/yr: (0.02 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.08 ton/yr PM10

SO2 lb/hr: (0.0025 MMscf/hr) * (0.6 lb/MMscf) = 0.002 lb/hr SO2

SO2 ton/yr: (0.002 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.007 ton/yr SO2

Northern Border Pipeline Company
Compressor Station No. 8 (Zeeland, North Dakota)
Permit No. T5-O84002
Title V Renewal Application
HE1 and HE2 Hazardous Air Pollutant Calculations

Emission Unit ID:	HE1 and HE2 (HE1 and HE2 are insignificant activities.)	
Description:	Heaters	
Max. Heat Input:	2.67	million British thermal units per hour (MMBtu/hr) (HHV)
Heating Value:	1,061	British thermal units per standard cubic foot (Btu/scf)
Fuel Usage:	0.0025	million standard cubic feet per hour (MMscf/hr)
Fuel Type:	Natural Gas	
Controls:	None	
Conversion:	2,000	lb/ton
Conversion:	8,760	hours per year

Pollutant	CAS Number	Emission Factor	Emission Factor Units	Emissions (lb/hr)	Emissions (ton/yr)
Acenaphthene	83-32-9	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Acenaphthylene	208-96-8	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Acetaldehyde	75-07-0	-	-	-	-
Acrolein	107-02-8	-	-	-	-
Anthracene	120-12-7	2.40E-06	lb/MMscf	6.04E-09	2.65E-08
Arsenic	7440-38-2	2.00E-04	lb/MMscf	5.03E-07	2.20E-06
Benzene	71-43-2	2.10E-03	lb/MMscf	5.28E-06	2.31E-05
Benzo(a)anthracene	56-55-3	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Benzo(a)pyrene	50-32-8	1.20E-06	lb/MMscf	3.02E-09	1.32E-08
Benzo(b)fluoranthene	205-99-2	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Benzo(e)pyrene	192-97-2	-	-	-	-
Benzo(g,h,i)perylene	191-24-2	1.20E-06	lb/MMscf	3.02E-09	1.32E-08
Benzo(k)fluoranthene	207-08-9	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Beryllium	7440-41-7	1.20E-05	lb/MMscf	3.02E-08	1.32E-07
Biphenyl	92-52-4	-	-	-	-
1,3-Butadiene	106-99-0	-	-	-	-
Cadmium	7440-43-9	1.10E-03	lb/MMscf	2.77E-06	1.21E-05
Carbon Tetrachloride	56-23-5	-	-	-	-
Chlorobenzene	108-90-7	-	-	-	-
Chloroform	67-66-3	-	-	-	-
Chromium	7440-47-3	1.40E-03	lb/MMscf	3.52E-06	1.54E-05
Chrysene	218-01-9	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Cobalt	7440-48-4	8.40E-05	lb/MMscf	2.11E-07	9.26E-07
1,3-Dichloropropene	53-70-3	-	-	-	-
Dibenzo(a,h)anthracene	53-70-3	1.20E-06	lb/MMscf	3.02E-09	1.32E-08
Dichlorobenzene	106-46-7	1.20E-03	lb/MMscf	3.02E-06	1.32E-05
7,12-Dimethylbenz(a)anthracene	57-97-6	1.60E-05	lb/MMscf	4.03E-08	1.76E-07
Ethylbenzene	100-41-4	-	-	-	-
Ethylene Dibromide	106-93-4	-	-	-	-
Fluoranthene	206-44-0	3.00E-06	lb/MMscf	7.55E-09	3.31E-08
Fluorene	86-73-7	2.80E-06	lb/MMscf	7.05E-09	3.09E-08
Formaldehyde	50-00-0	7.50E-02	lb/MMscf	1.89E-04	8.27E-04
Hexane	110-54-3	1.80E+00	lb/MMscf	4.53E-03	1.98E-02
Indeno(1,2,3-c,d)pyrene	193-39-5	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Manganese	7439-96-5	3.80E-04	lb/MMscf	9.56E-07	4.19E-06
Mercury	7439-97-6	2.60E-04	lb/MMscf	6.54E-07	2.87E-06
2-Methylnaphthalene	91-57-6	2.40E-05	lb/MMscf	6.04E-08	2.65E-07
3-Methylchloranthrene	56-49-5	1.80E-06	lb/MMscf	4.53E-09	1.98E-08
Methanol	67-56-1	-	-	-	-
Methylene Chloride	75-09-2	-	-	-	-
Naphthalene	91-20-3	6.10E-04	lb/MMscf	1.54E-06	6.72E-06
Nickel	7440-02-0	2.10E-03	lb/MMscf	5.28E-06	2.31E-05
Phenol	108-95-2	-	-	-	-
PAH	85-01-8	-	-	-	-
Perylene	108-95-2	-	-	-	-
Phenanathrene	85-01-8	1.70E-05	lb/MMscf	4.28E-08	1.87E-07
Propylene	129-00-0	-	-	-	-
Propylene Oxide	198-55-0	-	-	-	-
Pyrene	129-00-0	5.00E-06	lb/MMscf	1.26E-08	5.51E-08
Selenium	7782-49-2	2.40E-05	lb/MMscf	6.04E-08	2.65E-07
Styrene	100-42-5	-	-	-	-
Toluene	108-88-3	3.40E-03	lb/MMscf	8.56E-06	3.75E-05
Tetrachloroethane	79-34-5	-	-	-	-
1,1,2,2-Tetrachloroethane	79-34-5	-	-	-	-
1,1,2-Trichloroethane	79-00-5	-	-	-	-
2,2,4-Trimethylpentane	540-84-1	-	-	-	-
Vinyl Chloride	75-01-4	-	-	-	-
Xylene	108-38-3	-	-	-	-
Total HAPs				**0.005**	**0.0208**

The emission factors are based on AP-42, *Emission Factors for Speciated Organic Compounds From Natural Gas Combustion*, Tables 1.4-3 (July 1998) and *Emission Factors for Metals From Natural Gas Combustion,* Table 1.4-4 (July 1998).

Example Calculations:

Hexane lb/hr: (1.8 lb/MMscf) * (0.0025 MMscf/hr) = 0.005 lb/hr Hexane

Hexane ton/yr: (0.005 lb/hr) * (8,760 hr/yr) / (2,000 lb/ton) = 0.0198 ton/yr Hexane