

NATURAL GAS TRANSMISSION and PROCESSING APPLICATIONS GUIDANCE

This guidance is intended to help applicants prepare applications and certifications with a reduced amount of effort, yielding clearer and more accurate applications. We hope to steer new applicants around some common mistakes, allowing them to prepare applications which are complete on their first try.

The process involves preparation of facility descriptions, emissions estimates, and completion of some administrative forms. Two passes through the process may be required, calculating emissions based on worst-case assumptions, then adjusting those worst-case conditions and emissions if any level of significance is exceeded.

The pollutants of concern are nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC). Emissions of particulate matter (PM), and sulfur dioxide (SO₂) are normally negligible. These are referred to as “criteria pollutants.” In addition, there may be emissions of hazardous air pollutants (HAPs), primarily benzene, toluene, ethyl benzene, xylene, n-hexane, and formaldehyde.

“Potential emissions” do not take into account any limit on operations or any air pollution control devices present. However, actual emissions do take into account the limit on operations and control devices. If a facility has the potential to emit over 100 tons per year (TPY) but actual emissions are less than 100 TPY, then the facility is a *synthetic minor source*. If a facility has actual emissions of any one criteria pollutant in excess of 100 TPY, its permit should follow major source Title V application procedures. Any facility with a general permit for oil and gas facilities is considered a synthetic minor source.

Administrative Forms

The first thing to do is acquire a copy of the forms....

- A. Log onto the DEQ web page: www.deq.state.ok.us
- B. Go to the “Air Quality” page
- C. On the left side of the screen select “Forms”
- D. Selecting Permitting Forms
- E. Scroll down to “Oil and Gas Industry” and select either “Natural Gas Compressor Station Application” or “Oil & Gas Facilities - Minor Source General Permit Application”.

If you download the MS Word file, it may be completed on the computer and stored for later use.

Both the natural gas compressor station (NGCS) application and the Oil and Gas facilities (OGF) application include forms for engines, tanks, and other equipment typically found at oil and gas facilities. Information and emission estimates for additional units may be attached to the application. Example formats are provided in this document. Different formats may be used as long as calculations and emission rates are easily discernable.

Please note that the emission rate of the highest pollutant defines the facility. If a facility has actual emissions of 75 TPY NO_x, 60 TPY CO, and 40 TPY VOC, it is considered a 75 TPY facility. A true minor source facility will have potential and actual emissions below 100 TPY.

On the “General Facility Information” Form 100-884 for NGCS, please do not mark both construction and operating permit as this makes your application self-contradictory. Construction permits and operating permits are applied for separately. The same thing applies to forms 100-305-B, Notice of Intent to Construct; and 100-305-C-1, Notice of Intent to Operate. Please do not complete a Notice of Intent to Operate until DEQ has received the Notice of Intent to Construct and the facility has been constructed.

Additionally, the “SIC Code” means “Standard Industrial Classification Code.” These are 4922 for gas transmission and 1311 for gas liquids production.

The “Landowner Notification Affidavit” must be completed and signed for all applications (except for applicability determinations), but it is commonly overlooked, resulting in delays in processing applications and issuing permits.

All minor source applications are listed as “Tier I”.

Preparing Emissions Estimates

1. The engine manufacturer should provide emissions rating for each model of engine.

There is a great amount of confusion regarding “potential” emissions. It is common for engine manufacturers to list emissions under multiple conditions. For example, an engine model may be shown as having worst-case NO_x emissions of 18 grams per horsepower-hour (g/hp-hr) but emissions at crossover point of 10 g/hp-hr. For a hypothetical 800 HP engine, emissions would be, at worst-case:

$$800 \text{ HP} * 18 \text{ g/hp-hr} / 454 \text{ g/lb} = 31.72 \text{ lb/hr}$$

$$800 \text{ HP} * 18 \text{ g/hp-hr} * 24 \text{ hours/day} * 365 \text{ days/year} / 454 \text{ g/lb} / 2,000 \text{ lb/ton} \\ = 138.93 \text{ TPY}$$

This exceeds the major source threshold of 100 TPY, therefore a permit is required, either major or minor. A minor source permit may be obtained for crossover point operations:

$$800 \text{ HP} * 10 \text{ g/hp-hr} * 24 \text{ hrs/day} * 365 \text{ days/year} / 454 \text{ g/lb} / 2,000 \text{ lb/ton} = 77.18 \text{ TPY}$$

It will also be necessary to include estimates of formaldehyde emissions along with NO_x, CO, and VOC. If manufacturer data are available, they are usually the most reliable. If not, AP-42 Section 3.2 has factors for various types of engines (rich-burn, lean-burn, 2-stroke, and 4-stroke).

2. Most facilities include condensate storage tanks and dehydration units. EPA software, TANKS4.0, is used for estimating emissions of volatile organic compounds from storage tanks.

- A. Prepare a directory on your computer hard drive to receive the program, and where it will be installed later, for example, "C:\tanks."
- B. Log onto EPA's "Technology Transfer Network," www.epa.gov/ttn.
- C. Select "CHIEF" (Clearinghouse for Inventories and Emissions Factors).
- D. Select "Software and Tools."
- E. Select TANKS.
- F. TANKS4.0 can be downloaded.
- G. Install the program following instructions as provided by the program.

Condensate "flash" emissions must also be accounted for. A spreadsheet which calculates flash emissions based on the Vazquez-Beggs correlation is available online at http://www.deq.state.ok.us/AQDnew/resources/VBE_Aug2008.xls. However, if flash emissions exceed 50 TPY, you must determine tank emissions using a process simulator such as HYSIS or PROSIM. More information on calculating flash emissions can be found online at <http://www.deq.state.ok.us/aqdnew/permitting/AdviceDocuments.htm>.

For storage tanks containing lube oil (either new or used) or glycols, you generally will not need to prepare emissions estimates for those tanks unless these liquids are stored in tanks larger than 19,813 gallons. You will normally need to prepare estimates of emissions from condensate tanks and methanol tanks.

Please note that methanol, or methyl alcohol, will exceed the 1.5 psia vapor pressure threshold when its storage temperature exceeds 75°F, and this routinely happens during summer, even if the annual average temperature is lower.

3. Many facilities will involve dehydration units using glycol desiccants. GRI "GLY-CALC 4.0" is obtained from the Gas Technology Institute, (847)768-0500, 1700 South Mount Prospect Road, Des Plaines, Illinois 60018-1804.

The input to GLY-CALC involves a recent natural gas analysis. You should be aware that the higher the concentration of each component is shown, the higher its emissions

will be calculated. A safety factor may be applied to various components to assure that calculated emissions, and later emissions limitations, are high enough that the facility does not violate those limits. Additionally, if you input the capacity of the pump as the glycol circulation rate, you will not have to monitor that flow rate monthly; please be sure that the application states that the maximum rate of the pump has been used.

GLY-CALC allows for entering a condenser for control of organic compounds, including various hazardous air pollutants.

4. A dehydration unit reboiler, or any other small gas-fired heater, will have emissions of combustion products. Emissions factors for these units are obtained from EPA's TTN web site:

- A. Log onto EPA's "Technology Transfer Network," www.epa.gov/ttn
- B. Select "CHIEF" (Clearinghouse for Inventories and Emissions Factors)
- C. Select "Emission Factors"
- D. Select "AP-42"
- E. Select Chapter 1
- F. Download Section 1.4.

AP-42 is periodically updated, so limits based on these factors may become out-of-date. It may be to your advantage to include a safety factor on calculations provided that the resultant emissions do not exceed any level of significance such as a regulatory limit or a major source threshold.

5. Emissions of pollutants from flares may be estimated using factors in AP-42, Section 13.5. Downloading is identical to gas emission factors above, except for the different section.

6. Some facilities will have sweetening (amine) units which remove carbon dioxide (CO₂) and hydrogen sulfide (H₂S) from gas as received or from natural gas liquids. An estimate of SO₂ emissions resulting from flaring H₂S can be made from the maximum anticipated H₂S concentration (C_{H₂S}, normally expressed as ppm) and facility rated gas processing rate, MMSCFD.

$$\text{MMSCFD} * C_{\text{H}_2\text{S}} * 365 \text{ days/year} * 64 \text{ lb/lb-mole} / 385 \text{ SCF/lb-mole} / 1,000,000 \\ = \text{TPY SO}_2$$

Emission factors for other pollutants are in AP-42, Section 13.5.

7. For a transmission facility, VOC leakage from valves, flanges, etc., is normally negligible. For processing plants, fugitive VOC emissions are based on EPA's 1995 *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017) and an estimated number of components in C3+ service. This reference may also be obtained from www.epa.gov/ttn; factors are listed following in an example calculation.

EXAMPLES:

Here are some examples of how emissions from various units can be shown:

A. Engines

Engine No.	Engine Make	Capacity HP	NOx g/hp-hr	CO g/hp-hr	VOC g/hp-hr
C-1	Smith 123	800	3.0	3.5	1.0
C-2	Jones XYZ	600	2.0	2.0	0.5

Engine	NOx		CO		VOC	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
C-1	5.29	23.15	6.17	27.01	1.76	7.72
C-2	2.64	11.58	2.64	11.58	0.66	2.89

Engine	C-1	C-2
Control	Catalytic Converter	Catalytic Converter
Horsepower (max) hp	800	600
Fuel Consumption (BTU/hp-hr)	8,089	7,877
Fuel Usage (SCFH)	6,582	6,380
Stack Diameter (Inches)	9	8
Height above Grade (Feet)	19	15
Exhaust Flow (ACFM)	4,000	3,404
Exhaust Temperature (°F)	950	969

The stack flows at maximum horsepower output are normally provided by the engine manufacturer, along with fuel consumption. Fuel consumption may be listed as MMBTUH (million BTU per hour), SCFH (standard cubic feet per hour), or BTU/hp-hr (BTU per horsepower hour). If BTU/hp-hr is listed, multiply the value by engine rated horsepower and divide by fuel gas heating value (normally 1,000 BTU/SCF) to obtain SCFH fuel usage. For example, if an 800-HP engine is rated at 7,800 BTU/hp-hr, and fuel gas has a heating value of 1,020 BTU/SCF, fuel consumption will be:

$$800 \text{ HP} * 7,800 \text{ BTU/hp-hr} / 1,020 \text{ BTU/SCF} = 6,118 \text{ SCFH.}$$

B. Heaters

Unit	Capacity MMBTUH	Pollutant	Emission Factor, lb/MMBTU	Emissions	
				lb/hr	TPY
Dehy Reboiler	1.0	NO _x	0.100	0.100	0.44
		CO	0.084	0.084	0.38
		VOC	0.0053	0.005	0.02

C. Tanks

Tank No.	Contents	Capacity, Gallons	Vapor Pressure psia	Annual Throughput, Gallons	VOC Emissions, TPY
T-1	Methanol	1,500	1.5	15,000	0.68
T-2	Condensate	12,600	5.8	126,000	11.42

When you are uncertain of the annual throughput, please estimate high (10 or more turnovers per year).

D. Dehydration Still Vent

Pollutant	Controlled Emissions	
	lb/hr	TPY
n-Hexane	0.241	1.055
Benzene	0.189	0.829
Toluene	0.072	0.313
Ethyl Benzene	0.002	0.010
Xylene	0.005	0.022
Total HAP	1.022	4.475
Total VOC	4.54	19.88

GLYCALC includes an option for showing condensers or other air pollution control devices. A trial-and-error procedure is needed to find the discharge temperature at which emissions are adequately controlled. Once that temperature is determined, please include a print-out of results.

E. Fugitive VOC Leakage

Equipment	Number of Items	Emission Factor, lb/hr/source	lb/hr	TPY
Gas Valves	124	0.0032	0.401	1.755
Relief Valves	25	0.0063	0.158	0.692
Compressor Seals	18	0.0063	0.114	0.498
Connectors/Flanges	1,024	0.0003	0.287	1.256
Light Liquid Valves	217	0.0055	1.183	5.182

Relief Valves	50	0.0164	0.818	3.582
Pump Seals	20	0.0164	0.567	2.484
Connectors/Flanges	1,510	0.0005	0.687	3.010
TOTALS			4.215	18.459

F. Flare

Unit	Capacity MMBTUH	Pollutant	Emission Factor, lb/MMBTU	Emissions	
				lb/hr	TPY
F-1	1.0	NO _x	0.068	0.068	0.30
		CO	0.37	0.370	1.62
		VOC	0.14	0.140	0.61

The formats here are not rigid. Different formats may be used, but whatever is used should be clear enough that permit engineers can readily discern emission rates.

Additional Resources

More information on determining Potential to Emit can be found online in DEQ's Fact Sheets section and at <http://www.deq.state.ok.us/factsheets/air/ptefctst.pdf>.