Note:* *These are simplified procedures for typical facilities .

If an air permit is required at your site, if your emissions estimates require assistance from an engineer, or if the potential emissions at your site exceed the 80% limits in the "Overview" table, the Small Business and Local Government Assistance staff (SBLGA) will put you in contact with a TCEQ engineer for further guidance.

Example Emissions Estimate - Products of Combustion

- **Oxides of nitrogen (NO_x)**
- **Carbon monoxide (CO)**
- **Particulate matter (PM_{10})**
- **Volatile organic compounds (VOC)**
- **Sulphur dioxide (SO_2)**

Combustion emissions occur when fuel is burned (combusted). These emissions may harm the health of the general public when inhaled. Common sources of these emissions are boilers, heaters, turbines and engines. Permits by rule (PBR) for combustion processes are addressed separately below. Products of combustion emissions vary depending on the equipment used.

How do I estimate my products of combustion emissions?

After you select the permit by rule (PBR) that matches your process ("Do I need permission ..." in the "Overview") follow the instructions below for that PBR.

NOTES AS YOU PROCEED:

1. The estimation steps included here are valid ONLY for the source(s) specified and ONLY if the fuel you use is SWEET NATURAL GAS.
2. Your records must verify that hours of operation and amounts of fuel used are "worst case" - the source does not ever operate longer or use more fuel than indicated.
3. Your "worst case" estimations will be based on conservative emission factors for the single, major pollutant from your equipment (e.g., NO_x). If the limits are not exceeded by the major pollutant, similar limits will not be exceeded by the other pollutants.
4. Engineering judgement was used to determine the conservative factors used - source is the applicable natural gas combustion tables in the AP-42 Engineering Manual.
4. If your combustion unit is certified by the manufacturer as being a Low NO_x or Low NO_x Burner plus Flue Gas Recirculation application you may reduce your estimated NO_x emissions by 40%.
5. The "units" aspect of the estimation equations has been worked out for you. Therefore you must enter with values as specified, e.g., the size of the combustion source - maximum heat input - must be known in MM Btu/hr. You will make your estimations using raw numbers without "units"(e.g., use "40," not 40 MM Btu/hr, etc.).
6. If only the horsepower rating is known for your equipment, you may convert to MM Btu/hr using the conservative conversion factors specified.
7. Specifications, e.g., "maximum heat input" or "horsepower" may be "placarded" by the manufacturer on the device itself.
8. Annual fuel use may be determined from billing receipts.

IMPORTANT! ***If you use any fuel other than sweet natural gas, STOP HERE. Gather the information specified below under "What information will everyone need?" and "Products of Combustion - general data needed for calculations," later in this document, review all applicable technical guidance documents and call SBLGA. You will be put in contact with a TCEQ engineer for further guidance.***

Permit by Rule 106.183
(Boilers, Heaters and Other Combustion Devices)
S NO_x is the major pollutant from the type of equipment covered by this PBR

Illustration 1

We will examine "Facility B" which has a combustion device that meets the criteria in PBR 106.183. In this illustration Facility B knows only:

a) its boiler size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case," the boiler operates 8 hours/day, 5 days/week, 52 weeks/year - records verify the boiler never operates longer than this
c) **fuel used is sweet natural gas**

< To apply these estimating techniques to applications under PBR 106.183 the following values **must** be used:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information, or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert boiler horsepower to maximum heat input, multiply by 50,000 Btu/boiler hp)
- Use an average higher heating value for sweet natural gas of 1,020 Btu/scf (British thermal unit per standard cubic foot)
- Use a NO_x emission factor for sweet natural gas of 100 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emissions

[(Boiler size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)

[(40) ÷ (1,020)] x (100) = **3.92 lb/hr NO_x**

< Annual emissions

(Hours per day) x (Days per week) x (Weeks per year) = (Hours per year)
(Hours per year) x (Pounds per hour of emissions, from above) = (Annual emissions in pounds)
(Annual emissions in pounds) ÷ (2,000 pounds per ton) = (Annual emissions in tons)
(8 hrs/day) x (5 days/wk) x (52 wks/yr) = 2,080 hrs/yr
(2,080 hrs/yr) x (3.92 lb/hr) = 8,153.6 lb/yr
(8,153.6 lb/yr) ÷ (2,000 lb/ton) = **4.08 TPY NO_x**

Potential Emissions for "Facility B" are determined as shown below.

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(3.92 lb/hr) x (8,760 hrs/yr) = 34,339 lbs/yr
(34,339 lb/yr) ÷ (2,000 lb/ton) = **17.17 TPY NO_x**

Return to "What will I do with these emissions estimates?" in the "Overview."

Illustration 2

In this illustration "Facility B" does not know when or how long it's boiler operates. It knows only:

a) its boiler size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case," fuel use is 32 MM scf/yr - records verify the boiler never uses more fuel than this
c) **fuel used is sweet natural gas**

< To apply these estimating techniques to applications under PBR 106.183 the following values **must** be used:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert boiler horsepower to maximum heat input, multiply by 50,000 Btu/boiler hp)
- Use an average higher heating value for sweet natural gas of 1,020 Btu/scf (British thermal unit per standard cubic foot)
- Use a NO_x emission factor for sweet natural gas of 100 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emission rate is determined as shown earlier and repeated here

[(Boiler size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)
[(40) ÷ (1,020)] x (100) = **3.92 lb/hr NO_x**

< Annual emissions

[(Annual fuel use in MM scf/yr) x (The NO_x emission factor for this type of unit)] ÷ (2,000 pounds per ton) = (Annual emissions in tons)
[(32) x (100)] ÷ (2,000) = **1.6 TPY NO_x**

Potential Emissions for "Facility B" are determined as shown below.

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(3.92 lb/hr) x (8,760 hrs/yr) = 34,339 lbs/yr
(34,339 lb/yr) ÷ (2,000 lb/ton) = **17.17 TPY NO_x**

NOTE: The hourly emission rate is the same in both cases. Therefore, potential emissions, operating 24 hrs/day, 365 days/yr are also the same.

Return to "What will I do with these emissions estimates?" in the "Overview."

Permits by Rule 106.511, 512
(As applies to Portable and Emergency Turbines and Stationary Turbines - Engines are covered in the next section)

S NO_x is the major pollutant from this type of equipment covered by these PBRs

Illustration 3

We will examine "Facility C" which has a combustion device that meets the criteria in PBR 106.511 or 512. In this illustration Facility C knows only:

a) its turbine's rated size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case," the turbine operates 8 hours/day, 5 days/week, 52 weeks/year - records verify the turbine never operates longer than this
c) **fuel used is sweet natural gas**

< To use these estimating techniques under PBR 106.511 or 512 the following values **must** be applied:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information, or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert turbine horsepower to maximum heat input, multiply by 10,000 Btu/hp)
- Average higher heating value for sweet natural gas - 1,020 Btu/scf (British thermal unit per standard cubic foot)
- NO_x emission factor for sweet natural gas - 0.32 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emissions

[(Turbine size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)
[(40) ÷ (1,020)] x (0.32) = **0.013 lb/hr NO_x**

< Annual emissions

(Hours per day) x (Days per week) x (Weeks per year) = (Hours per year)
(Hours per year) x (Pounds per hour of emissions, from above) = (Annual emissions in pounds)
(Annual emissions in pounds) ÷ (2,000 pounds per ton) = (Annual emissions in tons)
(8 hrs/day) x (5 days/wk) x (52 wks/yr) = 2,080 hrs/yr
(2,080 hrs/yr) x (0.013 lb/hr) = 27.0 lb/yr
(27.0 lb/yr) ÷ (2,000 lb/ton) = **0.014 TPY NO_x**

Potential Emissions for "Facility C" are determined as shown below.

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(0.013 lb/hr) x (8,760 hrs/yr) = 113.9 lbs/yr
(113.9 lb/yr) ÷ (2,000 lb/ton) = **0.06 TPY NO_x**

Return to "What will I do with these emissions estimates?" in the "Overview."

Illustration 4

In this illustration "Facility C" does not know when or how long it's turbine operates. It knows only:

a) its turbine size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case" fuel use is 32 MM scf/yr - records verify the turbine never uses more fuel than this
c) **fuel used is sweet natural gas**

< To use these estimating techniques under PBR 106.511 or 512 the following values **must** be applied:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information, or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert turbine horsepower to maximum heat input, multiply by 10,000 Btu/hp)
- Average higher heating value for sweet natural gas - 1,020 Btu/scf (British thermal unit per standard cubic foot)
- NO_x emission factor for sweet natural gas - 0.32 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emission rate is determined as shown earlier and repeated here

[(Turbine size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)
[(40) ÷ (1,020)] x (0.32) = **0.013 lb/hr NO_x**

< Annual emissions

[(Annual fuel use in MM scf/yr) x (The NO_x emission factor for this type of unit)] ÷ (2,000 pounds per ton) = (Annual emissions in tons)
[(32) x (0.32)] ÷ (2,000) = **0.005 TPY NO_x**

Potential Emissions for "Facility C" are determined as shown below.

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(0.013 lb/hr) x (8,760 hrs/yr) = 113.9 lbs/yr
(113.9 lb/yr) ÷ (2,000 lb/ton) = **0.06 TPY NO_x**

NOTE: The hourly emission rate is the same in both cases. Therefore, potential emissions, operating 24 hrs/day, 365 days/yr are also the same.

Return to "What will I do with these emissions estimates?" in the "Overview."

Permits by Rule 106.511, 512
(As applies to Portable and Emergency Engines and Stationary Engines - Turbines were covered in the previous section)

S CO is the major pollutant but has a higher limit - NO_x is the pollutant of concern

Illustration 5

We will examine "Facility D" which has a combustion device that meets the criteria in PBR 106.511 or 512. In this illustration Facility D knows only:

a) its engine's rated size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case," the engine operates 8 hours/day, 5 days/week, 52 weeks/year - records verify the engine never operates longer than this
c) **fuel used is sweet natural gas**

< To use these estimating techniques under PBR 106.511 or 512 the following values **must** be applied:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information, or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert engine horsepower to maximum heat input, multiply by 10,000 Btu/hp)
- Average higher heating value for sweet natural gas - 1,020 Btu/scf (British thermal unit per standard cubic foot)
- NO_x emission factor for sweet natural gas - 2.27 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emissions

[(Engine size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)
[(40) ÷ (1,020)] x (2.27) = **0.09 lb/hr NO_x**

< Annual emissions

(Hours per day) x (Days per week) x (Weeks per year) = (Hours per year)
(Hours per year) x (Pounds per hour of emissions, from above) = (Annual emissions in pounds)
(Annual emissions in pounds) ÷ (2,000 pounds per ton) = (Annual emissions in tons)
(8 hrs/day) x (5 days/wk) x (52 wks/yr) = 2,080 hrs/yr
(2,080 hrs/yr) x (0.09 lb/hr) = 187.2 lb/yr
(187.2 lb/yr) ÷ (2,000 lb/ton) = **0.09 TPY NO_x**

Potential Emissions for "Facility D" are determined as shown below.

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(0.09 lb/hr) x (8,760 hrs/yr) = 788.4 lbs/yr
(788.4 lb/yr) ÷ (2,000 lb/ton) = **0.39 TPY NO_x**

Return to "What will I do with these emissions estimates?" in the "Overview."

Illustration 6

In this illustration "Facility D" does not know when or how long it's engine operates. It knows only:

a) its engine size is 40 million British thermal units (Btu) per hour, maximum heat input
b) "worst case" fuel use is 32 MM scf/yr - records verify the engine never uses more fuel than this
c) **fuel used is sweet natural gas**

< To use these estimating techniques under PBR 106.511 or 512 the following values **must** be applied:
- Maximum heat input for each unit must be specified in millions of Btu/hr (MM Btu/hr), e.g., "40 MM Btu/hr" - this information, or the unit's horsepower rating may be placarded on the equipment by the manufacturer (to convert engine horsepower to maximum heat input, multiply by 10,000 Btu/hp)
- Use an average higher heating value for sweet natural gas of 1,020 Btu/scf (British thermal unit per standard cubic foot)
- Use a NO_x emission factor for sweet natural gas of 2.27 lb/MM scf (pounds per million standard cubic feet)

Actual emissions are determined as follows:

< Hourly emission rate is determined as shown earlier and repeated here

[(Engine size in MM Btu/hr maximum heat input) ÷ (The average higher heating value of sweet natural gas)] x (The NO_x emission factor for this type of unit) = (NO_x emissions in pounds per hour)
[(40) ÷ (1,020)] x (2.27) = **0.09 lb/hr NO_x**

< Annual emissions

[(Annual fuel use in MM scf/yr) x (The NO_x emission factor for this type of unit)] ÷ (2,000 pounds per ton) = (Annual emissions in tons)
[(32) x (2.27)] ÷ (2,000) = **0.04 TPY NO_x**

Potential Emissions for "Facility D" are determined as shown below

< We will use hourly emissions previously estimated and multiply by 8,760 hours:
(24 hrs/day x 365 days/yr = 8,760 hours per year)

(Hourly emissions) x (Maximum possible annual hours of operation) = (Potential annual emissions in pounds)
(Potential annual emissions in pounds) ÷ (2,000 pounds per ton) = (Potential emissions in tons)

(0.09 lb/hr) x (8,760 hrs/yr) = 788.4 lbs/yr
(788.4 lb/yr) ÷ (2,000 lb/ton) = **0.39 TPY NO_x**

NOTE: The hourly emission rate is the same in both cases. Therefore, potential emissions, operating 24 hrs/day, 365 days/yr are also the same.

Return to "What will I do with these emissions estimates?" in the "Overview."

Permits by Rule 106.181, 182, 321, 322, 491, 492, 493, 495
Combustion Devices, Incinerators, Kilns, Furnaces and Flares

S The pollutant(s) of concern will vary with application

Due to the complicated techniques necessary to estimate product of combustion emissions from sources covered by these permits by rule, you will first gather specific, detailed information about your facility as shown below in "What information will everyone need?" and "Products of Combustion - general data needed for calculations." You will also review all applicable technical guidance documents. Call the SBLGA staff - they will put you in contact with a TCEQ engineer for further guidance.

What information will everyone need?

You will need basic (name, address) information and additional, process specific details.

Basic Information:

Business Name:_____

Physical Address: City _____ State:_____ Zip:_____

Contact Person:_____ Phone:_____ Fax:_____

"Worst Case," Maximum Operating Hours:
Daily:_____ AM to_____ PM

Maximum number of days per week:_____

Maximum number of weeks per year:_____

Products of Combustion - general data needed for calculations

PBRs 106.181, 182, 183, 321, 322, 491, 492, 493, 495, 511, 512

< Type of combustion unit (e.g., boiler or heater; kiln)

_____

_____

< Manufacturer's specifications for combustion unit (e.g., model number; type of burner; flue gas controls; expected emissions; maximum heat input in British thermal units [Btu] per hour)

_____

_____

_____

< Type of fuel(s) used (e.g., natural gas; propane; butane; fuel oil)

_____

< Maximum amount of fuel used

Fuel	Per Day	Per Year

If you are put in contact with a TCEQ engineer for further guidance, complete the applicable tables below:

< PBRs 106.181, 183
- Attach "Table 6, Boilers and Heaters" (TNRCC Form 10163)

< PBRs 106.182, 321, 322, 495, 511, 512
- Attach "Table 4, Combustion Units" (TNRCC Form 10159)

< PBRs 106.491, 493
- Attach "Table 5, Solid Waste Incineration Operational Data" (TNRCC Form 10161)

< PBR 106.492
- Attach "Table 8, Flare Systems" (TNRCC Form 10171)