PROPOSED AMENDED RULE 2012 PROTOCOL-CHAPTER 5

LARGE SOURCES AND PROCESS UNITS-SOURCE TESTING

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This chapter contains the source testing frequency requirements for large sources. Also included are the source testing methods and procedures necessary for a Facility Permit holder of a large NOx source or process unit to establish an alternative emission factor. The Facility Permit holder of a large source or process unit may use a statistically equivalent methodology upon approval by the Executive Officer. Statistically equivalent methodologies shall be submitted to the Federal Environmental Protection Agency as an amendment to the State Implementation Plan (SIP).

Large sources and process units differ in the methodology used to evaluate source test data and determine the validity of the results.

Every large NO_X source shall be source tested no later than December 31, 1996 for Cycle 1 facilities and June 30, 1997 for Cycle 2 facilities, and every three-year period ~~years~~ thereafter. In lieu of submitting the first source test report, the Facility Permit holder may submit the results of a source test not more than three years old which meets the requirements of this Chapter. The Facility Permit holder of a large source or NO_X process unit shall substantiate the emission rate according to the requirements set forth in this chapter.

All required source tests for RECLAIM NOx sources and process units shall be performed by testing firms/laboratories who have received approval under the District's Laboratory Approval Program.

A. Test Methods

The Facility Permit holders of all RECLAIM NO_X sources, when required, shall source test each equipment using the following test methods and procedures referenced in the District Source Test Manual and 40 CFR Part 60, Appendix A:

1. Determinations and measurements prior to sampling:

    a. Method 1.1 - sample points, stacks greater than 12 in. diameter

    b. Method 1.2 - sample points, stacks less than 12 in. diameter

    c. Method 2.1 - flow rate, stacks greater than 12 in. diameter

    d. Method 2.2 - flow rate, direct measurement

    e. Method 2.3 - flow rate, stacks less than 12 in. diameter

    f. Method 4.1 - moisture

    g. EPA Method 19 - calculated flow

    h. Direct in-stack instrumental flow measuring device

2. Nitrogen oxides concentration:

   a. Method 100.1 - nitrogen oxides

   b. Method 7.1 - nitrogen oxides

3. Oxygen concentration:

   a. Method 3.1 - molecular weight and excess air

   b. Method 100.1 - oxygen

4. [Reserved for methodology to measure NO_X emissions from process units.]

B. Summary of Testing Requirements

The Facility Permit holder is required to source test all Super Compliant major NOx sources, all large NOx sources, and all NO_X process units which opt for a concentration limit or emission rate as follows:

1. Super Compliant Major NOx Sources

   Once a Super Compliant major NOx source has been approved, the Facility Permit holder shall source test the equipment once every two calendar quarters. The test shall include a single 60 minute NOx concentration test and a relative accuracy audit of the fuel measuring device. If four consecutive bi-quarterly tests all show compliance, the testing frequency may be reduced to once per year.

2. Large NOx Sources

   A large NOx source is required to determine emissions based on the concentration limit in the Facility Permit. The Facility permit holder also has the option to determine emissions based on an emission rate. All large NOx sources shall be source tested according to one of the following:

   a. If the large source is subject to a RECLAIM concentration limit, ~~T~~the Facility Permit holder is required to source test each large NOx source once every three-year period, as specified in Rule 2012(j)(2) ~~years~~ to verify compliance with the concentration limit pursuant to Subdivision (D). This test shall include a single 60 minute NOx concentration test and a relative accuracy audit of the fuel measuring device. For sources that cannot be tested in accordance with Subdivision (D) due to high oxygen content and low carbon dioxide content in the exhaust stream, the Facility Permit holder may submit a permit application to request that the

compliance verification test be conducted pursuant to Subdivision (H) if the Facility Permit holder demonstrates that the source can be tested in accordance with procedures in Subdivision (H).

b. If the Facility Permit holder opts for an equipment specific emission rate, they are required to determine an equipment specific emission rate pursuant to Subdivision (E). These requirements include source testing the equipment for NOx mass emissions for three 30 minute runs at four different loads that span its normal operating range. The resulting data is required to pass a statistical "t-test" to be considered valid. Once the equipment specific emission rate is determined to be valid, the Facility Permit holder is then required to test its equipment every three-year period ~~years~~ to show that it is still in compliance with the equipment specific emission rate. This three-year test shall include testing the equipment for NOx mass emissions for one 30 minute run at each of the four original loads that span its normal operating range.

3. NOx Process Units

Emission factors are assigned to process units when the Facility Permit is issued. No source testing is required for a process unit, unless the Facility permit holder opts for either a concentration limit or an emission rate.

a. If the Facility Permit holder opts for a concentration limit, they are required to source test each process unit once every five-year period, as specified in Rule 2012(j)(4) ~~years~~ to verify compliance with the concentration limit pursuant to Subdivision (D). This test includes a single 60 minute NOx concentration test and a relative accuracy audit of the fuel measuring device. For process units that cannot be tested in accordance with Subdivision (d) due to high oxygen content and low carbon dioxide content in the exhaust stream, the Facility Permit holder may submit a permit application to request that the compliance verification test be conducted pursuant to Subdivision (H) if the Facility Permit holder demonstrates that the source can be tested in accordance with procedures in Subdivision (H).

b. If the Facility Permit holder opts for an equipment specific emission rate, they are required to determine an equipment specific emission rate pursuant to Paragraph (F)(1). These requirements include source testing the equipment for NOx mass emissions for three 30 minute runs at four different loads that span its normal operating range. The resulting data is required to pass a statistical "t-test" to be considered valid. Once the equipment specific

emission rate is determined to be valid, no further testing is required.

c. If the Facility Permit holder opts for a category specific emission rate, they are required to determine the category specific emission rate pursuant to Paragraph (F)(2). Once the category specific emission rate is determined to be valid, no further testing is required.

C. Testing frequency

The operator of all NO_X sources shall source test or tune-up their equipment according to the schedule in Table 5-B.

D. Concentration Limit

To verify compliance for a concentration limit for super compliant major NOx sources, large NOx sources, or process units, all of the following shall be met:

1. Submit a source testing plan to the District and receive written approval of the plan or follow a District standard source testing protocol;

2. Conduct the source test for a minimum of 60 minutes at a load within the normal operating range of the source which will represent the highest NOx concentration level;

3. Conduct a relative accuracy audit (RAA) for stack flow rate following the procedures in Appendix A, Chapter 3, Paragraph A(6) for super compliant major NOx sources and large NOx sources, and Appendix A, Chapter 4, Paragraph A(5) for process units; and

4. Perform these tests at the frequency specified in Table 5-B.

E. Guidelines for Testing to Establish an Equipment Specific Emission Rate for Large Sources

1. For large sources the Facility Permit holder may elect to establish an equipment specific emission rate that accurately represents the emissions from the source over the range of operation under which the testing was done. The equipment specific emission rate shall be used to determine compliance with the facility's annual emission cap.

2. The criterion for acceptability of the equipment specific emission rate shall be a 95% confidence interval that the tested emission rates will be within 20% of the equipment specific emission rate. If a single equipment

specific emission rate does not meet this criterion over the entire range of operation, the District will allow up to three equipment specific emission rates to cover a "normal operating range", a "high operating rate and a "low operating range," respectively. The "normal operating range" shall cover operations for at least 80% of the entire operating time. The equipment specific emission rate at the entire range or at respective low, normal, and high operating range shall be determined according to:

$$ER_c = (1/n) \sum_{i=1}^{n} ER_i \qquad \text{(Eq.32)}$$

$$S_{ER} = [\sum_{i=1}^{n} (ER_i - ER_c)^2/(n - 1)]^{1/2} \qquad \text{(Eq.33)}$$

$$CC = t_{0.975} S_{ER}/(n)^{1/2} \qquad \text{(Eq.34)}$$

$$C.I. (\%) = \frac{|CC|}{ER_c} \qquad \text{(Eq.35)}$$

where:

S_{ER} = The standard deviation (lb/mmBtu)

i = Each testing.

n = The number of testing data points to determine the equipment specific emission rate at entire range or low, normal, and high operating range, respectively

ER = The emission rate (lb/mmBtu) determined at each testing under each condition at the entire range or low, normal, and high operating range, respectively.

CC = The confidence coefficient

$t_{0.975}$ = The t value (one-tailed) determined from Table 5-A

ER_c = The equipment specific emission rate (lb/mmBtu) determined over an entire range, or determined at low, normal, and high operating range, respectively.

C.I. = The confidence interval with 95 % confidence level (%)

Table 5-A - Table of the Factor $t_{0.975}$ for Obtaining One-Tailed Confidence Interval for the Mean*

n*	$t_{0.975}$	n*	$t_{0.975}$	n*	$t_{0.975}$
6	2.571	9	2.306	12	2.201
7	2.447	10	2.262	13	2.179
8	2.365	11	2.228	14	2.160

* The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of individual values. 40 CFR Part 60, App B, Spec. 1.

3. The Facility Permit holder shall identify the monitoring parameter(s) to establish the allowable operating range of process variables to be specified in the Facility Permit for the affected sources from Table 3-A in Chapter 3 for large sources. This list is not intended to be all inclusive and the Facility Permit holder may identify additional parameters not listed in Table 3-A. The test conditions are typically related to percent of load; however, the Facility Permit holder may propose any other monitoring parameters as deemed necessary and propose the operating range of these monitoring parameters to ensure that the equipment specific emission rate(s) and control efficiency continue to fall within the confidence criterion.

4. The Facility Permit holder shall conduct source tests to verify the amended equipment specific emission rate according to the methods identified in Chapter 5, Subdivision A, or statistically equivalent methodologies. The testing shall be done in three phases.

5. Phase I testing shall constitute "normal operating range" testing. From the "normal operating range" the equipment specific emission rate shall be calculated by using the tested emission rates. To determine a tested equipment specific emission rate the Facility Permit holder shall test at four conditions that span the "normal operating range". At each condition an emission rate shall be tested three times, but not consecutively. If there are two (or more) monitoring parameters the Facility Permit holder shall identify the primary parameter (i.e. having the greatest effect on emission rate variation) and secondary monitoring parameter(s), (i.e. having the least effect on emission rate variation). The Facility Permit holder shall test at four conditions that span the "normal operating range" of the primary monitoring parameter and at each primary monitoring parameter condition, test at least two secondary monitoring parameter test conditions that span the "normal range" of the secondary operating monitoring parameter(s). Each test shall be conducted for a period of at least 30 minutes. On this basis, the equipment specific emission rate and the 95%

confidence interval shall be calculated. If the 95% confidence interval meets the 20% criterion, the unit shall be allowed to use this rate for "normal operating range" upon the approval of the Executive Officer. If the criterion is not met the Facility Permit holder shall reduce the "normal operating range" and conduct any additional tests to provide the required data sets.

6. Phase II testing shall constitute "high operating range" testing. The Facility Permit holder shall test at two conditions that span the "high operating range". At each condition an emission rate shall be tested three times, but not consecutively. Multiple operating conditions shall be addressed in a similar manner as described for Phase I testing. The values from these tests shall be added to the data from "normal operating range" testing and a test equipment specific emission rate and test 95% confidence interval shall be generated. If the 95% confidence interval for the test equipment specific emission rate meets the 20% criterion, then the test equipment specific emission rate shall become the allowed rate for both the "normal and high" operating ranges. If the criterion is not met, then a "high operating range" equipment specific emission rate and 95% confidence interval shall be calculated from the data. If the 20% criterion is met then the facility shall use this as a "high operating range" equipment specific emission rate. If the 20% criterion is not met then tests at two additional conditions within the high range shall be conducted and the 20% criterion again applied to the "high operating range" data set only. If the 20% criterion is still not met, then the "high operating range" shall be reduced.

7. Phase III testing shall constitute "low operating range" testing. This Phase testing is carried out in the same manner as Phase II testing. If a single "normal/high operating range" equipment specific emission rate has been determined from Phase II testing, then all of the data for "normal and high" operating range testing shall be included. If not, then only data from the "normal operating range" testing shall be included to create the "test equipment specific emission rate". The same acceptance criteria apply as specified under Phase II testing.

8. If the equipment specific emission rate in each phase complies with the Confidence Interval, the Facility Permit holder may use up to three equipment specific emission rates, each representing a different phase, provided that load duration for each specified phase equipment specific emission rate is monitored and recorded at the facility.

Example calculation:

In order to establish the equipment specific emission rate, the Facility Permit holder selected four operating conditions over the entire operating range. The results are as follows:

	Data 1	Data 2	Data 3
Condition 1	0.15	0.20	0.50
Condition 2	0.30	0.24	1.00
Condition 3	0.40	0.20	0.50
Condition 4	0.50	0.40	0.30

The confidence interval calculations are as follows:

ERc = (0.15 + 0.20 + 0.50 + 0.30 + 0.24 + 1.00 + 0.40 + 0.20 + 0.50 + 0.50 + 0.40 + 0.30)/12 = 0.39083

SER = 0.219196 (according to Eq.32)

CC = (2.201) * 0.219196/(11)1/2 = 0.1454

C.I.(%) = 0.1454/0.39083 = 37.2 % > 20 %

The proposed data set failed the confidence interval test, therefore the Facility Permit holder shall select low, normal, or high range, whichever is representative of their typical operating range according to Paragraphs 6.A.5.c.d.e.f. or g.

F. Guidelines for Testing to Establish Emission Rate for process units

1. Equipment Specific Emission Rate (ESER)

a. For process units the Facility Permit holder shall comply with an equipment specific emission rate that accurately represents the emissions from the source or the unit over the range of operation under which the testing was done. The equipment specific emission rate shall be used to determine compliance with the facility's annual emission cap.

b. The equipment specific emission rate shall be calculated by using tested emission rates from a "normal operating range". The "normal operating range" shall cover operations for at least 80% of the entire operating time. The criterion for acceptability of these tested emission rates shall be an 95% confidence interval that the tested emission rates will be within 25% of the equipment specific emission rate. The equipment specific emission rate over the "normal operating range shall be determined according to:

$$ER_c = (1/n) \sum_{i=1}^{n} ER_i \quad \text{(Eq.36)}$$

$$S_{ER} = [\sum_{i=1}^{n} (ER_i - ER_c)^2/(n - 1)]^{1/2} \quad \text{(Eq.37)}$$

$$CC = t_{0.975} S_{ER}/(n)^{1/2} \quad \text{(Eq.38)}$$

$$C.I. (\%) = \frac{|CC|}{ER_c} \quad \text{(Eq.39)}$$

where:

S_{ER} = The standard deviation (lb/mmBtu).

i = Each testing.

n = The number of testing data points to determine the equipment specific emission rate at the "normal operating range".

ER = The emission rate (lb/mmBtu) determined at each testing under each condition at the "normal operating range".

CC = The confidence coefficient.

$t_{0.975}$ = The t value (one-tailed) determined from Table 5-A.

ER_c = The equipment specific emission rate (lb/mmBtu) determined over the entire "normal operating range".

C.I. = The confidence interval with 95 % confidence level (%).

c. The Facility Permit holder shall identify the source test parameter(s) to establish the boundaries of operating conditions for the affected sources from Table 4-A in Chapter 4 for process units. This list is not intended to be all inclusive and the Facility Permit holder may identify additional source test parameters not listed in Table 4-A. The test conditions are typically related to percent of load; however, the Facility Permit holder may propose any other source test parameters as deemed necessary and propose the operating range of these source test parameters to ensure that the equipment specific emission rate(s) continue to fall within the confidence criterion.

d. The Facility Permit holder shall conduct source tests to verify the amended equipment specific emission rate according to the methods identified in Chapter 5, Subdivision A, or statistically equivalent methodologies. The testing shall be done over the "normal operating range".

e. From the "normal operating range" the equipment specific emission rate shall be calculated by using the tested emission rates. To determine a tested emission rate, the Facility Permit holder shall test at four conditions that span the "normal operating range". At each condition an emission rate shall be tested three times, but not consecutively. If there are two (or more) source test parameters the Facility Permit holder shall identify the primary source test parameter (i.e. having the greatest effect on emission rate variation) and secondary source test parameter(s), (i.e. having the least effect on emission rate variation). The Facility Permit holder shall test at four conditions that span the "normal operating range" of the primary source test parameter and at each primary source test parameter condition, test at least two secondary source test parameter test conditions that span the "normal range" of the secondary operating source test parameter(s). Each test shall be conducted for a period of at least 30 minutes. On this basis, the equipment specific emission rate and the 95% confidence interval shall be calculated. If the 95% confidence interval meets the 25% criterion, the unit shall be allowed to use this equipment specific emission rate for "normal operating range" upon the approval of the Executive Officer. If the criterion is not met the Facility Permit holder shall reduce the "normal operating range" and conduct any additional tests to provide the required data sets.

2. Category Specific Emission Rate (CSER)

a. For process units, the Facility Permit holder has, in lieu of a concentration limit or equipment specific emission rate (ESER), the option to establish, in the Facility Permit, with a category specific emission rate (CSER). A CSER is an average of ESERs of a group of three or more process units which:

i are the same type of equipment, i.e. equipment within a narrow range of rating, same manufacturer, family of model, and emission characteristics;

ii perform the same functions or processes;

iii meet the statistical limits of Clause (F)(2)(b)(ii); and

iv are all located at a single RECLAIM facility.

A CSER must be approved by the Executive Officer and listed in the Facility Permit before it may be used to determine compliance with the facility's annual emission cap.

b. The CSER is determined by the following:

i. A minimum of three devices of the category must be tested, and ESERs established for each of the three devices each meeting the statistical test methods for ESER in Paragraph F(1).

ii. The three ESERs will then be averaged to determine the CSER. The aggregate 36 tests of the three devices must pass a statistical "f-test" at a 95% confidence level for the CSER to be considered valid.

iii. Once the CSER has been established, approved as valid, and listed on the facility permit it can then be used to report emissions from the subject devices.

iv. To add one or more devices to this CSER, the new devices must meet the criteria in Subparagraph (F)(2)(a) and the facility must source test the new devices for one 30 minute run at each of the four loads the CSER was established. The results shall then be subjected, with the previous 36 tests, to the statistical "f" test and must meet at a 95% confidence level to be considered valid and the CSER applicable to the new devices.

G. Equipment tune-up procedures

Follow the "Equipment Tuning Procedure" as specified in Attachment D.

H. Alternative Method for Demonstrating Compliance with Concentration Limit

For sources that cannot be tested in accordance with Subdivision (D) due to high oxygen content and low carbon dioxide content in the exhaust stream, the Facility Permit holder may demonstrate compliance with the concentration limit using the following procedures:

1. The Facility Permit holder shall submit an application requesting use of this alternative compliance demonstration method. This alternative

method shall not be applicable unless the Facility Permit is re-issued to allow the use of this method.

2. This alternative method shall not be used unless the Facility Permit holder demonstrates to the satisfaction of the Executive Officer that the source meets all of the following requirements:

   a. The source cannot be tested in accordance to Subdivision D to demonstrate compliance due to high oxygen content and low carbon dioxide content in the exhaust from the source;

   b. The source can be tested using procedures under Paragraph H.3;

   c. The source only combusts one of the fuel types that is listed in Table 5-C;

   d. For sources with multiple points of emissions, each emission point from the source can be tested independently of other emission points to yield a single emission rate at ~~that~~each point; and

   e. The exhaust from the source contains no products of combustion other than those directly related to the combustion of fuels listed in Table 5-C.

3. The fuel meter shall be calibrated by a third party using procedures under Rule 2012, Appendix A, Chapter 3, Paragraph H.4, no more than 6 months prior to conducting the source test. If the source is served by a shared fuel meter, the source shall be tested when the other sources served by the same fuel meter are not consuming any fuel. The source shall be tested for a duration of 60 minutes using test methods and procedures referenced in the District Source Test Manual and 40 CFR Part 60, Appendix A to determine:

   a. Total mass of NOx emissions at each emission point;

   b. Total fuel consumed at each emission point; and

   c. Rate of emissions at each emission point in pounds per unit of fuel (e.g. pounds per million standard cubic feet for natural gas fired sources and pounds per 1000 gallons for fuel oil-fired sources).

4. Compliance with the concentration limit shall be demonstrated by comparing the tested emission rate (R_t) at each point of emission to the emission rate converted (R_c) from the Facility Permit concentration limit for the source, as expressed in the same units (e.g. lbs/mmscf or lbs/1000 gals), by using Eq. 41. In the event that at any emission point, the tested emission rate is greater than the converted emission rate, the source shall

be deemed to be operating in excess of the permitted concentration limit in violation of Rule 2012 (f)(2)(A) or Rule 2012(e)(2)(E), whichever is applicable for the source. In such case, the source shall be subject to the requirements of Rule 2004(g) and emissions from the source shall be determined using the higher tested emission rate until the day that the source is demonstrated to operate in compliance with the concentration limit as stated in the Facility Permit.

$$R_c = PPMV_{O2} \times [20.9/(20.9 - b)] \times 1.195 \times 10^{-7} \times F_d \times V \qquad \text{(Eq. 41)}$$

Where:

R_c = The emission rate converted from the Facility Permit concentration limit for the source.

$PPMV_{O2}$ = The RECLAIM Concentration Limit as listed in the Facility Permit and based on standardized oxygen concentration in the exhaust stream.

b = The standard concentrations of oxygen (%) as listed in the Facility Permit or as found in Table 3-F if not listed in the Facility Permit

F_d = The dry F factor for oxygen for each type of fuel, the ratio of the dry gas volume of the products of combustion to the heat content of the fuel (dscf/mmBtu), as specified in Table 5-C or as determined during the same source test used to obtain the emission rate.

V = The higher heating value of the fuel for each type of fuel found in Table 5-C or as determined during the same source test used to obtain the emission rate.

Example:

Natural gas-fired Boiler permitted at 30 ppmv, 3% O_2 and vented to a single stack

Total mass of NOx based on source test = 21 lbs

Fuel consumed during the source test = 0.8 mmscf

F_d = 8710 dscf/mmBtu

V = 1050 mmBtu/mmscf

R_c = 30 ppmv x [20.9/(20.9 – 3)] x 1.195x 10^{-7}

x 8710 dscf/mmBtu x 1050 mmBtu/mmscf

R_c = 38.3 lb/mmscf

and,

R_t = (21 lbs)/(0.8 mmscf) = 26.25 lbs/mmscf

Thus,

$R_t < R_c$ → In Compliance

TABLE 5-B
SOURCE TESTING AND TUNE-UP FREQUENCY(1)

EQUIPMENT	TEST PER Q.A. PROGRAM	TEST EVERY THREE-YEARS PERIOD	TUNE-UP ONCE A YEAR	TUNE-UP TWICE A YEAR	TEST EVERY TWO CALENDAR QUARTERS	TEST EVERY FIVE-YEARS PERIOD
BOILERS AND HEATERS						
Process Units				X[4]		
Large Sources		X		X[4]		
Major Sources	X					
I.C.E.						
Process Units			X[2,5]			
Large Sources		X		X[2,5]		
Major Sources	X					
KILNS/CALCINERS						
<10 TONS/HR		X				
>10 TONS/HR	X					
TAIL GAS UNITS	X					
FCCU	X					
PORTABLE EQUIPMENT			X			
ALL OTHER EQUIPMENT[3]			X			
Super Compliant Major Source					X[6]	
Process Unit with Concentration Limit						X

1 Does not include Rule 219 Exempt Equipment.

2 To Manufacturer's Specification.

3 Does not include Equipment where combustion gases produce reducing and oxidizing conditions as part of the process (for example, metal melting furnaces which provide various alloys.

4 If a boiler or heater does not operate at all during a continuous six-month period within a compliance year, only one tune-up is required for that compliance year. No tune-up is required during a compliance year for any boiler or heater that is not operated at all during the entire compliance year. Test firings are not considered operation for the purposes of these tune-up requirements so long as such test firings are done to verify availability of the unit for their intended use and once such test firings are completed the units are shutdown. Records of the date and

duration when the unit is test fired shall be maintained for a period of three years, and shall be made accessible to the Executive Officer upon request.

5 If an ICE classified as a large NOx source does not operate at all during a continuous six-month period within a compliance year, only one tune-up is required for that compliance year. No tune-up is required during a compliance year for an ICE classified as a large NOx source or a NOx process unit that is not operated at all during the entire compliance year. Records of any operation shall be maintained for a period of three years, and shall be made accessible to the Executive Officer upon request.

6. If four consecutive bi-quarterly tests all show compliance, the testing frequency may be reduced to once per year.

TABLE 5-C
DRY F-FACTORS AND HIGHER HEATING VALUES

Fuel Type	(F_d) Dry F-Factor	(V) Higher Heating Value
Natural Gas	8710 dscf/mmBtu	1050 mmBtu/mmscf
LPG, Propane, Butane	8710 dscf/mmBtu	94 mmBtu/mgal
Diesel	9190 dscf/mmBtu	137 mmBtu/mgal
Fuel Oil	9190 dscf/mmBtu	150 mmBtu/mgal