

Model General Permit Sample Calculations for Natural Gas/No. 2 Oil fired boilers

The following is an example calculations that was performed for boilers. The calculations were based on the highest size boiler allowed within the range for the General Permit.

Basis:

- 45.0 mmBtu/hour maximum heat input
- 700000 gallons No. 2 Fuel Oil used per year
- 140000 Btu/gallon of fuel oil
- 1020 Btu/scf natural gas

Calculation of number of hours on fuel oil				
gal/yr	Btu/gallon	hr/mmBtu	Hours	
700000	140000	2.22E-08	2178	Max hr/yr on fuel oil
			6582	Remaining hr/y for NG
			8760	Total Possible Hours

- 100 lbs NOx/mm scf gas burned - AP-42¹
- 0.6 lbs SO₂/mm scf gas burned - AP-42¹
- 84 lbs CO/mm scf gas burned - AP-42¹
- 7.6 lbs PE/mm scf gas burned - AP-42¹
- 11 lbs OC/mm scf gas burned - AP-42¹

- 20 lbs NOx/1000 gallon No. 2 Fuel Oil burned - AP-42²
- 71 lbs SO₂/1000 gallon No. 2 Fuel Oil burned - AP-42²
- 5 lbs CO/1000 gallon No. 2 Fuel Oil burned - AP-42²
- 2 lbs PE/1000 gallon No. 2 Fuel Oil burned - AP-42²
- 0.252 lbs OC/1000 gallon No. 2 Fuel Oil burned - AP-42²

Emissions Calculations For Natural Gas Combustion							
PInt	(Btu/hr)	(scf/1020 Btu)	(lb PInt/mm scf)	lb PInt/hr	(hr/yr) ³	(ton/2k lb)	T/Y
NOx	4.5E+07	0.00098	0.0001	4.41	6582	0.0005	14.52
SO ₂	4.5E+07	0.00098	6E-07	0.03	6582	0.0005	0.09
CO	4.5E+07	0.00098	8.4E-05	3.71	8760	0.0005	16.23
PE	4.5E+07	0.00098	7.6E-06	0.34	6582	0.0005	1.10
OC	4.5E+07	0.00098	1.1E-05	0.49	8760	0.0005	2.13

lb/mmBtu Allowable ⁵
0.098
0.001
0.082
0.007
0.011

Emissions Calculations For No. 2 Fuel Oil Combustion							
PInt	(Btu/hr)	(gallon/Btu)	(lb PInt/1k gal)	lb PInt/hr	(hr/yr)	(ton/2k lb)	Ton/Year
NOx	4.5E+07	0.00001	0.02	6.43	2178	0.0005	7.00
SO ₂	4.5E+07	0.00001	0.071	22.82	2178	0.0005	24.85
CO	4.5E+07	0.00001	0.005	1.61	0	0.0005	0.00
PE	4.5E+07	0.00001	0.002	0.64	2178	0.0005	0.70
OC	4.5E+07	0.00001	0.000252	0.08	0	0.0005	0.00

lb/mmBtu Allowable ⁵
0.143
0.507
0.036
0.014
0.002

Combined Ton/Year ^{4,5}	
NOx	21.52
SO ₂	24.94
CO	16.23
PE	1.80
OC	2.13

¹ AP-42 emission factor for natural gas combustion for small boilers, uncontrolled (Section 1.4, Table 1.4-1 and 1.4-2)

² AP-42 emission factor for distillate oil combustion for boilers (Section 1.3, Table 1.3-1 - 1.3-3)

³ 8760 hours per year was used when the short term emissions were worse case for natural gas. Otherwise, it was assumed the 700,000 gallons of fuel oil was burned and the remaining time was on natural gas.

⁴ For NOx, SO₂ and PE, this is based on the emissions on burning 700,000 gallons of fuel oil plus the remaining fuel for the year as natural gas. For CO and OC, this is based on burning natural gas the entire year.

⁵ Bold text delineate the short term and annual limits to be used for the permit.