

AVERAGING PLAN FOR IC ENGINES AND TURBINES

a) System-wide averaging plan: An owner or operator may comply with the requirements of subsections (a) and (b) of this Section by averaging the emissions of affected units that commenced operation on or before January 1, 2002, unless the unit is a replacement unit, in which case such a unit may be included even if it commenced operation after January 1, 2002. A replacement unit is a unit that replaces a pre-existing engine or turbine used for the same purpose as the replaced unit.

1) Compliance shall be determined on both an ozone season (May 1 to September 30) and an annual (January 1 to December 31) basis each year. For the affected units identified in an averaging plan, the total mass of NO_x emissions must be equal to or less than the total mass of allowable NO_x emissions for the units for both the ozone season and calendar year, based on the limits specified in subsections (a) and (b) of this Section. The following equations shall be used to determine compliance:

$$N_{\text{actual}} \leq N_{\text{allowable}}$$

Where:

$$N_{\text{actual}} = \sum_{i=1}^n EM_{\text{actual}_i}$$

$$N_{\text{allowable}} = \sum_{i=1}^n EM_{\text{allowable}_i}$$

Where:

$$N_{\text{actual}} = \text{Mass of actual NO}_x \text{ emissions from units included in the averaging plan for each fuel used (pounds per ozone season and year).}$$

$$N_{\text{allowable}} = \text{Mass of allowable NO}_x \text{ emissions from units included in the averaging plan for each fuel used (pounds per ozone season and year).}$$

For each engine or turbine in the averaging plan, and each fuel used by such engines and turbines, determine actual and allowable NO_x emissions using the following equations:

$$EM_{\text{allowable}_i} = E_{\text{allowable}_i} * H_i$$

$$EM_{\text{actual}_i} = E_{\text{actual}_i} * H_i$$

$$E_{\text{allowable}_i} = C_{d_{\text{allowable}_i}} * F_{d_i} * \left[\frac{20.9}{(20.9 - \%O_{2_{d_i}})} \right]$$

$$E_{\text{actual}_i} = C_{d_{\text{actual}_i}} * F_{d_i} * \left[\frac{20.9}{(20.9 - \%O_{2_{d_i}})} \right]$$

Where:

$EM_{\text{allowable}}$ = Total mass of allowable NOx emissions (pounds)

EM_{actual} = Total mass of actual NOx emissions (pounds)

$E_{\text{allowable}}$ = Allowable NOx emission rate (lbs/mmBTU)
calculated according to the above equation

E_{actual} = Actual NOx emission rate (lbs/mmBTU)
calculated according to the above equation

H = Heat input (mmBtu/ozone season or
mmBtu/year) calculated from fuel flowmeter and
heating value of the fuel used.

$C_{d_{\text{actual}}}$ = Actual concentration of NOx in lb/scfd (ppmv x
 1.194×10^{-7}) on a dry basis for fuel used.
Actual concentration is determined from the
average of three most recent test runs performed
pursuant to ASTM D 6522-00 or stack test data
as specified by Section 217.392.

$C_{d_{\text{allowable}}}$ = Allowable concentration of NOx in lb/scfd
(ppmv x 1.194×10^{-7}) on a dry basis for fuel
used and allowable limit specified in Section
217.388(a) and (b).

F_d = The ratio of the gas volume of the products of
combustion to the heat content of the fuel
(dscf/mmBtu) as given in the table of F Factors
or as determined using 40 CFR 60, Appendix A,
Method 19.

$\%O_{2d}$ = Percent oxygen in affluent gas stream measured
on a dry basis.

n = Number of different engines or turbines in the
averaging plan

i = Subscript denoting an individual engine or
turbine and fuel used.

Case 1

Engines	Rated HP	Allowable NOx Limit (PPM)	Allowable NOx Limit (lb/Mbtu)	Actual NOx (PPM)	Actual NOx (lb/Mbtu)	Fuel Usage (Mbtu/yr)	Operating Hours	HP-hr	Allowable EM (lb)	Actual EM (lb)
RB Engine 1	3,000	150	0.553	175	0.645	127,500	5,000	15,000,000	70,456	82,199
LB Engine 2	3,500	210	0.774	220	0.810	148,750	5,000	17,500,000	115,078	120,558
Diesel Engine 3	4,000	660	2.565	700	2.721	170,000	5,000	20,000,000	436,121	462,553
LB Engine 4	4,500	210	0.774	150	0.553	191,250	5,000	22,500,000	147,958	105,684
Turbine 5 (4 MW)	5,361	42	0.155	50	0.184	227,843	5,000	26,805,000	35,253	41,968
Total						637,500	25,000	101,805,000	804,866	812,962

NOx Emissions Fuel usage * C_d * F_d * 20.9 / (20.9 - %O_{2d})

C_d is pollutant concentration in lb/scfd (PPM * conversion factor for NOx 0.0000001194 from table 19-1 of method 19),

F_d is conversion factor for various fuels in dscf/Mbtu from table 19-2 of method 19,

and O_{2d} is % of oxygen which is 15 for our rule.

EM allowable (lb/yr) 127500*150*0.0000001194*8710*20.9/(20.9-15) + 148750*210*0.0000001194*8710*20.9/(20.9-15) + 170000*660*0.0000001194*9190*20.9/(20.9-15) + 191250*210*0.0000001194*8710*20.9/(20.9-15) + 227843*42*0.0000001194*8710*20.9/(20.9-15)
804,866

EM actual (lb/yr) 127500*175*0.0000001194*8710*20.9/(20.9-15) + 148750*220*0.0000001194*8710*20.9/(20.9-15) + 170000*700*0.0000001194*9190*20.9/(20.9-15) + 191250*150*0.0000001194*8710*20.9/(20.9-15) + 227843*50*0.0000001194*8710*20.9/(20.9-15)
812,962

Case 2

Engines	Rated HP	Allowable NOx Limit (PPM)	Allowable NOx Limit (lb/Mbtu)	Actual NOx (PPM)	Actual NOx (lb/Mbtu)	Fuel Usage (Mbtu/yr)	Operating Hours	HP-hr	Allowable EM (lb)	Actual EM (lb)
RB Engine 1	3,000	150	0.553	175	0.645	114,750	4,500	13,500,000	63,410	73,979
LB Engine 2	3,500	210	0.774	220	0.810	133,875	4,500	15,750,000	103,570	108,502
Diesel Engine 3	4,000	660	2.565	700	2.721	156,400	4,600	18,400,000	401,231	425,548
LB Engine 4	4,500	210	0.774	150	0.553	232,475	6,078	27,350,010	179,851	128,465
Turbine 5 (4 MW)	5,361	42	0.155	50	0.184	227,843	5,000	26,805,000	35,253	41,968
Total						637,500	24,678	101,805,010	783,316	778,463

EM allowable (lb/yr) 114750*150*0.0000001194*8710*20.9/(20.9-15) + 133875*210*0.0000001194*8710*20.9/(20.9-15) + 156400*660*0.0000001194*9190*20.9/(20.9-15) + 232475*210*0.0000001194*8710*20.9/(20.9-15) + 227843*42*0.0000001194*8710*20.9/(20.9-15)
783,316

EM actual (lb/yr) 114750*175*0.0000001194*8710*20.9/(20.9-15) + 133875*220*0.0000001194*8710*20.9/(20.9-15) + 156400*700*0.0000001194*9190*20.9/(20.9-15) + 232475*150*0.0000001194*8710*20.9/(20.9-15) + 227843*50*0.0000001194*8710*20.9/(20.9-15)
778,463