J. Standard
3/28/79

Caterpillar Tractor - Joliet Plant

Stack Test Results:

#2 Boiler

Particulate Emissions = $0.155 \frac{lb}{MMBTU}$ (Avg. 3 tests)

SO_2 Emissions = $0.242 \frac{lb}{MMBTU}$ (Avg. 6 tests)

#3 Boiler

Particulate Emissions = $0.188 \frac{lb}{MMBTU}$ (Avg. 2 tests)

SO_2 Emissions = $0.289 \frac{lb}{MMBTU}$ (Avg. 4 tests)

Applicable Regulations:

Particulates [Rule 203(g)(1)(A)] = $0.1 \frac{lb}{MMBTU}$

SO_2 [Rule 204(c)(1)(A)] = $1.8 \frac{lb}{MMBTU}$

Annual Particulate Emissions

#2 Boiler

Heat Content = 10,435 $\frac{BTU}{Lb}$ (Avg. 3 tests - stack tests)

$$10435 \frac{BTU}{Lb_c} \times \frac{2000 lb}{T_c} \times \frac{MMBTU}{10^6 BTU} = 20.87 \frac{MMBTU}{T_c}$$

Actual:

$$0.155 \frac{lb_p}{MMBTU} \times 20.87 \frac{MMBTU}{T_c} \times 9267 \frac{T_c}{yr} \times \frac{T_p}{2000 lb_p} = 15.0 \frac{T_p}{yr}$$

Allowable:

$$15.0 \times \frac{0.1}{0.155} = 9.7 \frac{T_p}{yr}$$

#3 Boiler

Heat Content = 10,722 $\frac{BTU}{Lb_c}$ (Avg. 2 tests - stack test)

$$10,722 \frac{BTU}{lb_c} \times \frac{2000 lb_c}{T_c} \times \frac{MMBTU}{10^6 BTU} = 21.44 \frac{MMBTU}{T_c}$$

Actual:

$$0.188 \frac{lb_p}{MMBTU} \times 21.44 \frac{MMBTU}{T_c} \times 9762 \frac{T_c}{yr} \times \frac{T_p}{2000 lb_p} = 19.7 \frac{T_p}{yr}$$

Allowable:

$$19.7 \times \frac{0.1}{0.188} = 10.5 \frac{T_p}{yr}$$

SUMMARY

(Particulate Emissions relative to Rule 203 (g)(1)(A))

	Emissions $\left(\frac{lb}{MMBTU}\right)$		Emissions $\left(\frac{T}{yr}\right)$	
Boiler	Actual	Allowed	Actual	Allowed
#2	0.155	0.1	15.0	9.7
#3	0.188	0.1	19.7	10.5

Particulate Emissions based on 114 data & Emission Factor

Boiler #2

Spreader stoker unit

Bituminous Coal: Annual consumption = 9267 T_c

Heat content = 21.6 $\frac{MMBTU}{T_c}$

Ash content = 10.1% = A

Emission factor (Table 1.1-2, AP-42) = 13A $\frac{lb_p}{T_c}$

Air cleaning equipment (Multiclone and wet scrubber), operating efficiency = 96.5% (114 data)

$$\text{Emissions, } E_p = (13)(10.1)\frac{lb_p}{T_c} \times \frac{T_c}{21.6\ MMBTU} \times (1-0.965) = 0.21\ \frac{lb_p}{MMBTU}$$

Annual emissions:

$$0.21\ \frac{lb_p}{MMBTU} \times 21.6\ \frac{MMBTU}{T_c} \times 9267\ \frac{T_c}{yr} \times \frac{T_p}{2000\ lb_p} = 21.0\ \frac{T_p}{yr}$$

$$\text{allowable emissions} = 21.0 \times \frac{0.1}{0.21} = 10.0\ \frac{T_p}{yr}$$

Boiler #3

Spreader stoker unit

Bituminous coal : Consumption $= 9762 \frac{Tc}{yr}$

Heat content $= 21.6 \frac{MMBTU}{Tc}$

ash content $= 10.1\% = A$

Emission factor (Table 1.1-2, AP-42) $= 13A \frac{lbp}{Tc}$

Air cleaning equipment (multiclone & scrubber), operating efficiency = 96.5% (114 data)

Emissions, $E_p = 13(10.1) \frac{lbp}{Tc} \times \frac{Tc}{21.6\ MMBTU} \times (1-0.965) = 0.21 \frac{lbp}{MMBTU}$

Annual Emissions:

$0.21 \frac{lbp}{MMBTU} \times 21.6 \frac{MMBTU}{Tc} \times 9762 \frac{Tc}{yr} \times \frac{Tp}{2000 lbp} = 22.1 \frac{Tp}{yr}$

Allowable emissions $= 22.1 \times \frac{0.1}{0.21} = 10.5 \frac{Tp}{yr}$

Boiler #2

Actual emissions = $0.155 \frac{lb}{MMBTU}$

Collection efficiency of air cleaning equipment = 96.5%

Uncontrolled emissions = $\frac{0.155}{(1-.965)} = 4.43 \frac{lb}{MMBTU}$

Allowable emissions = $0.1 \frac{lb}{MMBTU}$

∴ Required collection efficiency:

$$0.1 = 4.43\left(1 - \frac{E}{100}\right)$$

$$E = 97.7\%$$

Boiler #3

Actual emissions = $0.188 \frac{lb}{MMBTU}$

Collection efficiency of air cleaning equipment = 96.5%

Uncontrolled emissions = $\frac{0.188}{(1-.965)} = 5.37 \frac{lb}{MMBTU}$

Allowable emissions = $0.1 \frac{lb}{MMBTU}$

∴ Required collection efficiency = $5.37\left(1 - \frac{E}{100}\right) = 0.1$

$E = 98.1\%$