LAMPIRAN

Data Emisi Gas Buang Hasil Pembakaran Menggunakan Insinerator

Tanggal 23 Desember 2024

Pembakaran 1 Insinerator				
No	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)
1	0.69	5.7	68	14.32
2	0.49	3.9	115	16.11
3	0.34	3.4	70	16.8
4	0.27	4.1	76	15.94
5	0.23	4.1	67	15.92
6	0.16	3.3	56	16.87
7	0.18	3.6	55	16.43
8	0.28	5.6	58	14.42
9	0.16	4.2	51	15.83
10	0.23	3.4	47	16.85
Rata-Rata	**0.303**	**4.13**	**66.3**	**15.949**

Pembakaran 2 Insinerator				
No	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.23	3.8	41	15.94
2	0.68	12.5	55	7.16
3	0.48	6.6	63	13.41
4	0.70	10.9	56	8.78
5	0.27	5.3	41	14.87
6	0.44	6.3	38	13.66
7	0.25	3.5	46	16.06
8	0.09	2.6	49	17.75
9	0.31	3	51	17.23
10	0.16	2.5	62	17.88
Rata-Rata	**0.361**	**5.7**	**50.2**	**14.274**

Pembakaran 3 Insinerator				
No	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.44	3.3	74	16.83
2	0.33	3.1	76	17.16
3	0.20	5.5	47	14.49
4	0.26	7.2	60	12.65
5	0.41	9.2	81	10.43
6	0.22	7.7	50	11.88
7	0.73	8.7	97	10.81
8	0.35	6.3	69	13.44
9	0.30	5.6	63	14.29
10	0.16	4.2	52	15.78
Rata-Rata	**0.34**	**6.08**	**66.9**	**13.776**

Data Emisi Gas Buang Hasil Pembakaran Menggunakan *Cone nozzle* pada *Ventury Wet Scrubber*

25 Desember 2024

Pembakaran 1 Cone Nozzle				
No	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.04	1.2	13	19.61
2	0.07	1.9	17	18.71
3	0.09	2.1	27	18.35
4	0.04	0.8	34	19.78
5	0.06	1.2	13	19.65
6	0.08	1.8	15	19.03
7	0.08	1.6	15	19.16
8	0.05	0.9	8	19.88
9	0.03	0.4	2	20.42
10	0.01	0.3	1	20.55
Rata-Rata	**0.055**	**1.22**	**14.5**	**19.514**

Pembakaran 2 Cone Nozzle				
No	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.03	1.3	5	19.56
2	0.05	1.4	7	19.35
3	0.07	2.5	5	18.12
4	0.1	2.2	8	18.36
5	0.08	1.9	17	18.82
6	0.07	1.8	18	19.04
7	0.06	1.5	13	19.28
8	0.05	1.3	15	19.44
9	0.04	1.2	13	19.56
10	0.04	1	10	19.72
Rata-Rata	**0.059**	**1.61**	**11.1**	**19.125**

Pembakaran 3 Cone Nozzle				
No	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.03	2.5	13	18.17
2	0.07	3	18	17.4
3	0.09	1.7	17	18.92
4	0.1	1.9	24	18.79
5	0.09	2.1	25	18.62
6	0.12	1.9	31	18.79
7	0.09	1.7	26	19.04
8	0.08	1.5	28	19.23
9	0.07	1.3	23	19.54
10	0.05	1	19	19.77
Rata-Rata	**0.079**	**1.86**	**22.4**	**18.827**

Nilai Rata-Rata Emisi Gas Buang Hasil Pembakaran 1-3 Tanpa Menggunakan *Cone nozzle* pada *Ventury Wet Scrubber*

Average Cone Nozzle Off				
Combustion	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.303	4.13	66.3	15.949
2	0.361	5.7	50.2	14.274
3	0.34	6.08	66.9	13.776
Average	**0.334667**	**5.30333**	**61.133333**	**14.666**

Nilai Rata-Rata Emisi Gas Buang Hasil Pembakaran 1-3 *Cone nozzle* pada *Ventury Wet Scrubber*

Average Cone Nozzle On				
Combustion	**CO (%)**	**CO_2 (%)**	**HC (ppm)**	**O_2 (%)**
1	0.055	1.22	14.5	19.514
2	0.059	1.61	11.1	19.125
3	0.079	1.86	22.4	18.827
Average	**0.064333**	**1.563333**	**16**	**19.1553**

Perhitungan Persentase Penurunan Emisi Gas Buang

A. Nilai CO

Nilai Rata-Rata *Cone Nozzle Off*

$$\frac{(0.303 + 0.361 + 0.34)}{3} = 0.33$$

Nilai Rata-Rata *Cone Nozzle On*

$$\frac{(0.055 + 0.059 + 0.079)}{3} = 0.064$$

Combustion 1

$$\frac{(0.055 - 0.303)}{0.303}\ x\ 100\ \% = 81.85\ \%$$

Combustion 2

$$\frac{(0.059 - 0.361)}{0.361}\ x\ 100\ \% = 83.65\ \%$$

Combustion 3

$$\frac{(0.079 - 0.34)}{0.34}\ x\ 100\ \% = 76.76\ \%$$

Average

$$\frac{(0.064 - 0.33)}{0.33}\ x\ 100\ \% = 80.60\ \%$$

B. Nilai CO2

Nilai Rata-Rata *Cone Nozzle Off*

$$\frac{(4.13 + 5.7 + 6.08)}{3} = 0.33$$

Nilai Rata-Rata *Cone Nozzle On*

$$\frac{(1.22 + 1.61 + 1.86)}{3} = 0.064$$

Combustion 1

$$\frac{(1.22 - 4.13)}{4.13}\ x\ 100\ \% = 70.46\ \%$$

Combustion 2

$$\frac{(1.61 - 5.7)}{5.7}\ x\ 100\ \% = 71.75\ \%$$

Combustion 3

$$\frac{(1.86 - 6.08)}{6.08}\ x\ 100\ \% = 69.41\%$$

Average

$$\frac{(1.56 - 5.3)}{5.3}\ x\ 100\ \% = 70.56\ \%$$

C. Nilai HC

Nilai Rata-Rata *Cone Nozzle Off*

$$\frac{(66.3 + 50.2 + 66.9)}{3} = 61.1$$

Nilai Rata-Rata *Cone Nozzle On*

$$\frac{(14.5 + 11.1 + 22.4)}{3} = 16$$

Combustion 1

$$\frac{(14.5 - 66.3)}{66.3}\ x\ 100\ \% = 78.13\ \%$$

Combustion 2

$$\frac{(1.11 - 50.2)}{50.1}\ x\ 100\ \% = 77.88\ \%$$

Combustion 3

$$\frac{(22.4 - 66.9)}{66.9}\ x\ 100\ \% = 66.51\ \%$$

Average

$$\frac{(16 - 61.1)}{61.1}\ x\ 100\ \% = 73.81\ \%$$

D. Nilai O2

Nilai Rata-Rata *Cone Nozzle Off*

$$\frac{(15.949 + 14.274 + 13.776)}{3} = 14.666$$

Nilai Rata-Rata *Cone Nozzle On*

$$\frac{(12.514 + 19.125 + 18.827)}{3} = 19.155$$

Combustion 1

$$\frac{(19.514 - 15.949)}{15.949}\ x\ 100\ \% = -18.26\ \%$$

Combustion 2

$$\frac{(19.125 - 14.274)}{14.274}\ x\ 100\ \% = -25.36\ \%$$

Combustion 3

$$\frac{(18.827 - 13.776)}{13.778}\ x\ 100\ \% = -26.82\ \%$$

Average

$$\frac{(19.155 - 14.666)}{14.666}\ x\ 100\ \% = -23.43\ \%$$

PERHITUNGAN KONVERSI EMISI GAS CO DARI % KE mg/Nm^3 SESUAI STANDAR MENTERI LHK

Perhitunagn konversi % → mg/Nm^3. Sesuai Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor: P.70/Menlhk/Setjen/Kum.1/8/2016 Tentang Baku Mutu Emisi Usaha Dan/Atau Kegiatan Pengolahan Sampah Secara Termal.

- Perhitungan *Cone Nozzle Off*

  Diketahui :

  - Nilai CO *cone nozzle off* = 0.33 % → 3300 ppm
  - Massa Molekul CO = 28.01 g/mol
  - Volume Molar = 24.45 L/mol (pada suhu 25°C dan 1 atm)

  Maka,

  mg/Nm^3 = ppm x $\frac{Massa\ Molekul\ CO}{Volume\ Molar}$

  = 3300 x $\frac{28.01}{24.45}$

  = 3780 mg/Nm^3

- Perhitungan *Cone Nozzle On*

  Diketahui :

  - Nilai CO *cone nozzle On* = 0.064 % → 640 ppm
  - Massa Molekul CO = 28.01 g/mol
  - Volume Molar = 24.45 L/mol (pada suhu 25°C dan 1 atm)

  Maka,

  mg/Nm^3 = ppm x $\frac{Massa\ Molekul\ CO}{Volume\ Molar}$

  = 640 x $\frac{28.01}{24.45}$

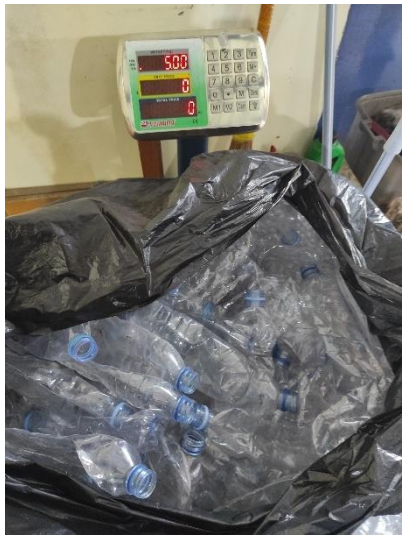
  = 733 mg/Nm^3

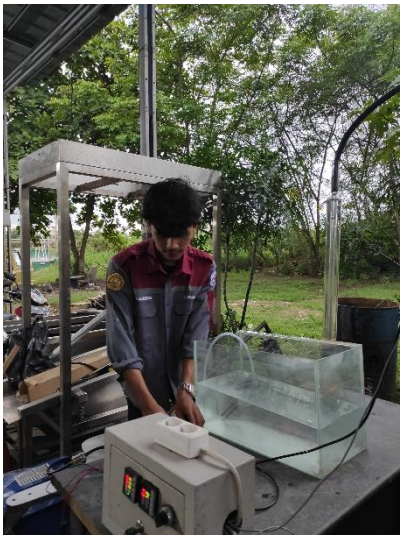
  Maka, didapatkan perbandingan nilai emisi gas CO yang sudah didapatkan dengan Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor: P.70/Menlhk/Setjen/Kum.1/8/2016 Tentang Baku Mutu Emisi Usaha Dan/Atau Kegiatan Pengolahan Sampah Secara Termal. Masih belum memenuhi standar, adapun tabel perbandingan dapat dilihat sesuai tabel berikut ini:

Variabel	Nilai Hasil Emisi Gas CO		
	Nilai Konversi (mg/Nm^3)	**Standar Menteri LHK (mg/Nm^3)**	**Klasifikasi**
Cone Nozzle Off	3780	625	**Tidak Memenuhi Standar**
Cone Nozzle On	733	625	**Tidak Memenuhi Standar**

DOKUMENTASI PENGAMBILAN DATA

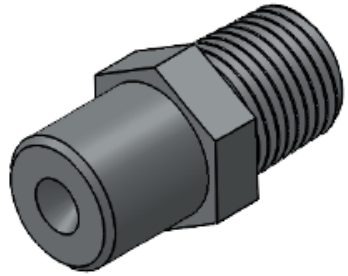


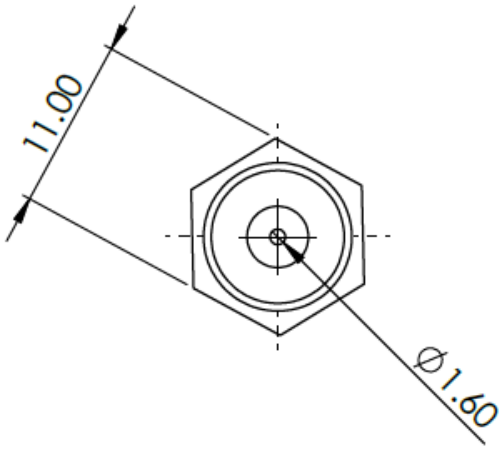



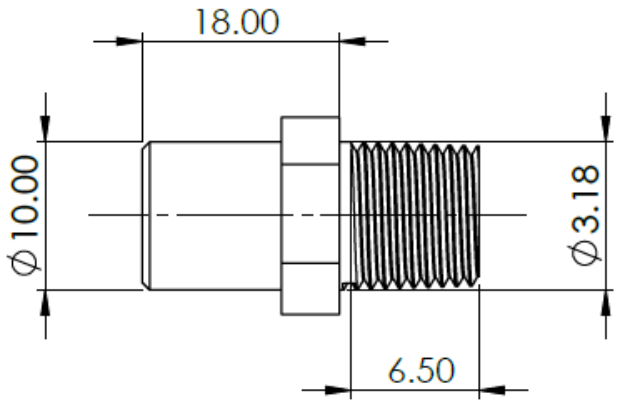



4 Gas
Emission
Analyzer
2024/12/25
PM 5:26
CAR NUMBER: 2000
CO : 0.04 %
HC : 13 ppm
CO2 : 1.2 %
O2 : 19.61 %
LAMBDA: 2.000
AFR : 0.0
FUEL : GASOLINE
H/C : 1.8500
O/C : 0.0000


4 Gas
Emission
Analyzer
2024/12/25
PM 5:28
CAR NUMBER: 3000
CO : 0.07 %
HC : 17 ppm
CO2 : 1.9 %
O2 : 18.71 %
LAMBDA: 2.000
AFR : 0.0
FUEL : GASOLINE
H/C : 1.8500
O/C : 0.0000







	SKALA : 2:1	DIGAMBAR : VENIDA ALAN DEVARA	KETERANGAN:
	UKURAN : MM	NPM : 3331210030	
	TANGGAL : 14-05-25	DIPERIKSA :	
FT UNTIRTA	CONE NOZZLE	LAMPIRAN	A4