

**Stack Height Calculation**

**Flue Gases**

Flow		150,850 Nm <sup>3</sup> /h
Temperature	T <sub>d</sub>	134 °C
Moisture	% v/v	16.4%
Oxygen	% v/v dry	4.9%
Reference Flow	Dry, 11% O <sub>2</sub>	202,851 Nm <sup>3</sup> /h
	V	224,894 Actual m <sup>3</sup> /h
Heat release	Q	6.563 MW
Exit Velocity	Required	20.0 m/s
Stack Diameter	Required Max	1.994 m
	Actual	1.635 m
Exit Velocity	Actual	29.8 m/s

$$Q = \frac{V \left(1 - \frac{283}{T_d}\right)}{2.9} (MW)$$

**Pollution Index Calculation**

Pollutant	Emission Concentration	Discharge Rate	Guideline Concentration	Background Concentration	Pollution Index
	At Reference Conditions	D	G <sub>d</sub>	B <sub>c</sub>	P <sub>i</sub>
	mg/m <sup>3</sup>	g/s	mg/m <sup>3</sup>	mg/m <sup>3</sup>	m <sup>2</sup> /s
HCl	30	1.690	0.800	0.002	2,117
SO <sub>2</sub>	100	5.635	0.266	0.007	21,737
Total Acid gases					23,855
CO	375	21.130	10	0.488	2,221
Particulate	30	1.690	0.050	0.037	132,065
NO <sub>2</sub>	300	16.904	0.200	0.038	104,476
Lead	0	0.00E+00	5.00E-04	2.50E-05	0
Dioxins	0.00E+00	0.00E+00	5.00E-10	2.66E-10	0
				<b>Pollution Index P<sub>i</sub></b>	<b>132,065</b>

$$P_i = \frac{D}{(G_d - B_c)} \times 1000$$

G<sub>d</sub> values are taken from National Air Quality Strategy for short term quality standards. See reference Library>ADMS section> AQSO or from D1 where no EQS exists

P<sub>i</sub> for calculation purposes is maximum value in table above

**Buoyancy Calculation**

a	-1.4401
b	0.5283
Uncorrected Stack Height U <sub>b</sub>	18.42
Minimum U <sub>b,min</sub>	3.06 <U <sub>b</sub>

Q>1MW

$$a = -0.84 - 0.1 \exp(Q^{0.31})$$

$$b = 0.46 + 0.011 \exp(Q^{0.31})$$

Q<1MW

$$a = -1.11 - 0.19 \times \log Q$$

$$b = 0.49 + 0.005 \times \log Q$$

$$U_b = 10^a \times P_i^b$$

$$U_b \text{ min} = 1.7 + 0.25 \times Q^{0.9}$$

**Momentum Calculation**

Velocity w	29.8 m/s
Stack Diameter d	1.63 m
Momentum M	1293
x	-0.922
y	3.958
z	-13.819
Log(U <sub>m</sub> )	1.618
U <sub>m</sub>	41.46
U <sub>m,min</sub>	8.12 <U <sub>m</sub>

$$M = \frac{283}{T_d} \times V \times w$$

$$\log_{10} U_m = x + \sqrt{y \log_{10} P_i + z}$$

$$x = -3.7 + (\log_{10} M)^{0.9}$$

$$y = 5.9 - 0.624 \log_{10} M$$

$$z = 4.24 - 9.7 \log_{10} M + 1.47 (\log_{10} M)^2 - 0.07 (\log_{10} M)^3$$

$$U_m \text{ min} = 0.82 \times M^{0.32}$$

**Buildings**

Affected radius 5U <sub>m</sub>	207.3 m
Uncorrected height U	18.42 U <sub>b</sub>
A	2.25 U <sub>m</sub> /U <sub>b</sub>

(lesser of U<sub>m</sub> and U<sub>b</sub>)

$$C = H + 0.6 \left\{ U + (2.5H - U) \left( 1 - A^{U/H} \right) \right\}$$

Buildings and Structures within 5U<sub>m</sub>

	Boiler House	Straw Barn 2	Turbine Hall	Wood Storage	Straw Barn 2
Distance from stack	16.00	36.43	15.00	21.00	20.78
Height	32.00	18.00	12.00	14.10	18.00
Width (perpendicular to line of stack)	34.95	72.85	30.65	13.50	72.85
K (lesser of H or B)	32.00	18.00	12.00	13.50	18.00
T = (H+1.5K)	80.00	45.00	30.00	34.35	45.00
Number of Buildings	Do not Ignore 5	Do not Ignore 5	Do not Ignore 5	Do not Ignore 5	Do not Ignore 5

Height H <sub>m</sub>	32
T <sub>m</sub>	80 H+1.5K
C	56.8
C*	56.8
Multiple Buildings?	YES Use C*
Is U>2.5H?	NO Use C*
Is U>T with multiple buildings?	NO Use C*
	C 56.8

$$C^* = H_m + \left( 1 - \frac{H_m}{T_m} \right) \times \left[ U + (T_m - U) \left( 1 - A^{U/H_m} \right) \right]$$

**CORRECTED STACK HEIGHT = 57 m**  
Rounded up to nearest metre