

	Discharge Rate g s^{-1}	Background concentration mg m^{-3}	Guideline concentration mg m^{-3}	Source	Pollution Index (P_i) $\text{m}^3 \text{s}^{-1}$
CO	0.008	0.23	10	AQS	0.819
NO ₂	0.042	0.01391	0.2	AQS	225.697
NO	0.013	0.01957	1		12.852
O ₃	0.000		0.1	AQS	0.000
Pb	0.000		0.00025	AQS	0.000
SO ₂	0.000	0.00326	0.35	AQS	0.000
PM10	0.000	0.01276	0.05	AQS	0.000
PM2.5	0.000	0.00726	0.012	AQS	0.000

Nett heat loss from boiler stack (Q)

0.187

MW

Exhaust gas temperature (T_d)

134

°C

407.15

K

Stack diameter (d)

0.3

m

Discharge velocity (w)

12.000

m s^{-1}

Uncorrected stack height due to buoyancy:

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

when

$Q \leq 1$

$$a = -1.11 - 0.19 \log_{10} Q$$

=

-0.972

$$b = 0.49 + 0.005 \log_{10} Q$$

=

0.486

$Q > 1$

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

=

-1.021

$$b = 0.46 + 0.011 \text{Exp}(Q^{0.32})$$

=

0.480

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

=

1.489 m

when

$Q \leq 1$

$$U_{b \min} = 1.95 Q^{0.19}$$

=

1.418 m

$Q > 1$

$$U_{b \min} = 1.7 + 0.25 Q^{0.9}$$

=

1.755 m

Since $Q \leq 1$

$$U_b =$$

=

1.489 m

Uncorrected stack height due to discharge momentum: $\log_{10} U_m = x + (y \cdot \log_{10} P_i + z)^{0.5}$

$$\text{where; } M = \frac{283}{T_d} \cdot \frac{W^2 d^2}{4} = 7.075$$

$$x = -3.7 + (\log_{10} M)^{0.9} = -2.836$$

$$y = 5.9 - 0.624 \log_{10} M = 5.370$$

$$z = 4.24 - 9.7 \log_{10} M + 1.47 (\log_{10} M)^2 - 0.07 (\log_{10} M)^3 = -2.984$$

$$\log_{10} U_m = x + (y \cdot \log_{10} P_i + z)^{0.5} = 0.271$$

$$\text{Therefore } U_m = 10^{0.271} = 1.865$$

$$U_{m \min} = 0.82 M^{0.32} = 1.755 \text{ m}$$

$$U_m = 1.865 \text{ m}$$

Final discharge height, C, corrected for nearby buildings

Consider all buildings within $5U_m$ i.e. 9.327 m of the flue

$$H = \text{height of tallest building (to the ridge or other highest point ignoring protrusions such as tank rooms less than 1% of the roof area)} = 7.200 \text{ m}$$

$$U = \text{lesser of } U_m \text{ or } U_b = 1.489 \text{ m}$$

$$\text{Where } U > 2.5H \quad C = U = 1.489 \text{ m}$$

$$\text{else} \quad C = H + 0.6(U + (2.5H - U) \cdot (1 - A^{-U/H})) = 8.544 \text{ m}$$

$$\text{where} \quad A = U_m / U_b = 1.252$$

$$\text{Since } U < 2.5H \quad C = 9 \text{ m} \quad (\text{rounded up to the nearest metre})$$