

# Atmospheric dispersion of air pollutants

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## Slide#22 solution)

1) Effective stack height

$$\begin{aligned}\Delta H &= \frac{v_s d}{u} \left[ 1.5 + \left( 2.68 \times 10^{-2} \cdot P \cdot \left( \frac{T_s - T_a}{T_s} \right) \cdot d \right) \right] \\ &= \frac{10 \text{ m/s} \cdot 1.2 \text{ m}}{4.5 \text{ m/s}} \left[ 1.5 + \left( 2.68 \times 10^{-2} \cdot 95.0 \text{ kPa} \cdot \left( \frac{588 \text{ K} - 298 \text{ K}}{255 \text{ K}} \right) \cdot 1.2 \text{ m} \right) \right] \\ &= 8.0 \text{ m} \\ H &= 120 \text{ m} + 8 \text{ m} = 128 \text{ m}\end{aligned}$$

2) Stability class

“overcast” – at overcast conditions (thick clouds), the stability class is **D** (neutral) at any time of the day

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## Slide#22 solution – cont'd)

3) Coefficients

$$x = 3 \text{ km}$$

$$a = 68, c = 44.5, d = 0.516, f = -13.0$$

$$\sigma_y = a \cdot x^{0.894} = 68.3 \cdot 3^{0.894} = 181.6 \text{ m}$$

$$\sigma_z = c \cdot x^d + f = 44.5 \cdot 3^{0.516} - 13 = 65.4 \text{ m}$$

4) Concentration

$$\begin{aligned}C(x, y, 0) &= \left( \frac{E}{\pi u \sigma_y \sigma_z} \right) \left[ \exp \left( \frac{-y^2}{2\sigma_y^2} \right) \right] \left[ \exp \left( \frac{-H^2}{2\sigma_z^2} \right) \right] \\ C(3, 0, 0) &= \left( \frac{1656 \text{ g/s}}{\pi \cdot 4.5 \text{ m/s} \cdot 181.6 \text{ m} \cdot 65.4 \text{ m}} \right) \left[ \exp(0) \right] \left[ \exp \left( \frac{-(128 \text{ m})^2}{2 \cdot (65.4 \text{ m})^2} \right) \right] \\ &= 1.5 \times 10^{-3} \text{ g/m}^3\end{aligned}$$

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