

HW#4 SO₂ Concentration Downwind of Two Emission Sources

Name _____

Due Oct. 9, 2008 in Class

Given: Two electrical generating power power plants located adjacent to each other (similar to the two 700 Megawatt coal fueled boilers at the Centralia Power Plant).
 Effective Stack Height = 500 ft = H
 Boiler A stack emission of SO₂ = 5 gm/sec = Q_A
 Boiler B stack emission of SO₂ = 3 gm/sec = Q_B
 Wind speed = 5 miles/hour = u Atm Stability Class = B
 Distance between Stack A and Stack B = 500 ft Downwind distance = 900m = x

Find: Use the Gaussian distribution plume dispersion equation with plume reflection from the ground surface (eq 4.13 pp 110 W&W 2nd Ed) to calculate the 10 minute average concentrations of SO₂

- a) Boiler A SO₂ Downwind Concentration (μg/m³)
 at downwind distance of x = 900 m (y_A = 0) _____ μg/m³
- b) Boiler B SO₂ Downwind Concentration (μg/m³)
 at downwind distance of x = 900 m (y_B = 0) _____ μg/m³
- c) SO₂ Downwind Concentration of emissions from *both* Boilers A and B
 at a downwind distance of 900 m and y_A = - 250 ft and y_B = + 250 ft _____

Attach your calculations; write your "final answers" above

$H := 500 \cdot \text{ft}$ $H = 152.4 \text{ m}$ **Atm Stability Class B** $u := 5 \cdot \frac{\text{mi}}{\text{hr}}$ $\mu\text{g} := (10^{-6}) \cdot \text{gm}$
 $Q_A := 5 \cdot \frac{\text{gm}}{\text{sec}}$ $Q_B := 3 \cdot \frac{\text{gm}}{\text{sec}}$ $y_A := -250 \cdot \text{ft}$ $y_B := 250 \cdot \text{ft}$ $x := 900 \cdot \text{m}$ $x = 2952.8 \text{ ft}$

These σ_{yB} & σ_{zB} approximation equations for atm stability class B are for downwind distances x less than 1 kilometer or 1000 meters; (W&W 2nd Ed pp 115)

$$\sigma_{yB} := (156 \cdot \text{m}) \cdot \left(\frac{x}{\text{km}}\right)^{0.894}$$

$$\sigma_{zB} := (106.6 \cdot \text{m}) \cdot \left(\frac{x}{\text{km}}\right)^{1.149} + 3.3 \cdot \text{m}$$

→ u = 5 miles/hr ←

