

Air Pollution Control Technology

Air Pollution Modelling

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Chapter Description

- Aims
 - To promote air monitoring procedure and guidelines required by Malaysia's government
- Expected Outcomes
 - Students are able to explain the aim and classification of air pollution model (APM)
 - Students are able to predict the ambient air concentration using a fixed box mode
- References
 - Valerro, Daniel A. 2008. Fundamentals of air pollution. 4th edition. Elsevier.



Approaches of modelling

Physical model

- meteorological around source
- time consuming and difficult to conduct

Mathematical model

- transport of pollutant
- law of conservation of mass
- tools for formulating rational AQM

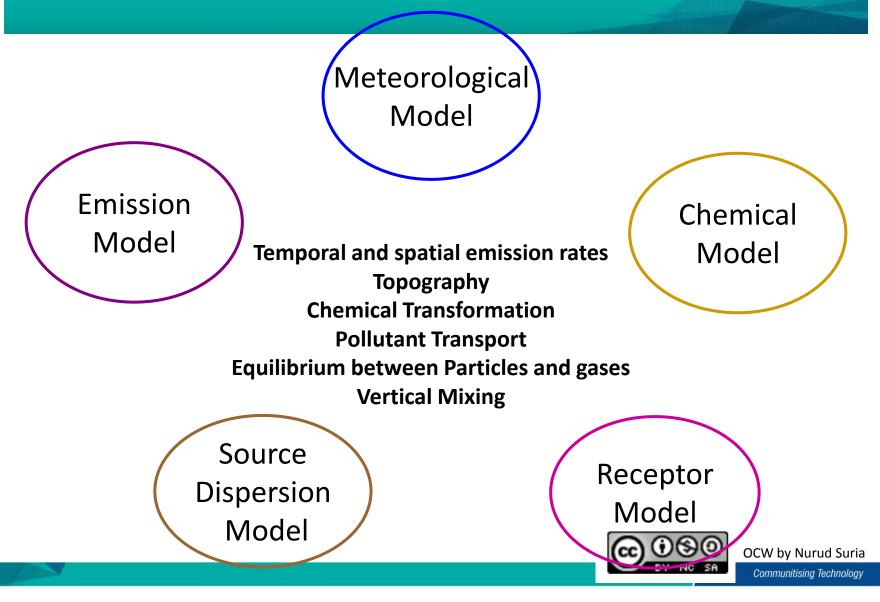


Air Quality Model

- Air Quality Models are mathematical formulations that include parameters that affect pollutant concentrations.
- They are used to
 - Evaluate compliance with NAAQS and other regulatory requirements
 - Determine extent of emission reductions required
 - Evaluate sources in permit applications



Types of Air Quality Model



Atmospheric stability

Table: Key to stability category

Surface wind speed (at 10 m) m/s	Day			Night	
	Incoming solar energy			Thinly overcast	Clear or <
	Strong	Moderate	Slight	or > 4/8 cloud	3/8 cloud
0-2	А	A-B	В	-	-
2-3	A-B	В	С	E	F
3-5	В	B-C	С	D	E
5-6	С	C-D	D	D	D
>6	С	D	D	D	D

Source: Handbook of Environmental engineering , 4th edition



Example 6.3



 $Q = 20 \text{ g/s of } SO_2 \text{ at Height H}$ u = 3 m/s,

At a distance of 1 km, $\sigma_y = 30$ m, $\sigma_z = 20$ m (given) <u>Required</u>: (*at* x = 1 km)

a) SO₂ concentration at the center line of the plume

b) SO₂ concentration at a point 60 m to the side of and 20 m below the centerline



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... solution of example 6.4



$$c = \frac{Q}{2\pi u \sigma_y \sigma_z} \exp\left[-\left(\frac{y^2}{2\sigma_y^2} + \frac{(z-H)^2}{2\sigma_z^2}\right)\right]$$

a) At the centerline

$$y = 0, \quad z - H = 0 \implies e^{0} = 1$$

$$c = \frac{Q}{2\pi u \sigma_{y} \sigma_{z}} = \frac{20 \,(\text{g/s})}{2\pi (3 \,\text{m/s})(30 \,\text{m})(20 \,\text{m})} = .00177 \,\text{g/m}^{3} = 1770 \,\mu\text{g/m}^{3}$$



... solution of example 6.4



b) At a point 60m to the side and 20 m below the CL $y = 60 \text{ m}, \quad z - H = -20 \text{ m}$ $c = \frac{20 (\text{g/s})}{2\pi (3 \text{ m/s})(30 \text{ m})(20 \text{ m})} \exp \left[-\left(\frac{60^2}{2(30)^2} + \frac{(-20)^2}{2(20)^2}\right) \right]$ $= (1770 \ \mu\text{g/m}^3)(0.0818) = 145 \ \mu\text{g/m}^3$





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