Implementation of Meteorological Data and Atmospheric Dispersion Model for Radiological Consequence Analysis.

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Objective

The main objective of this study is to evaluate appropriate selection of dispersion model and their efficient implementation in radiological safety and emergency response.

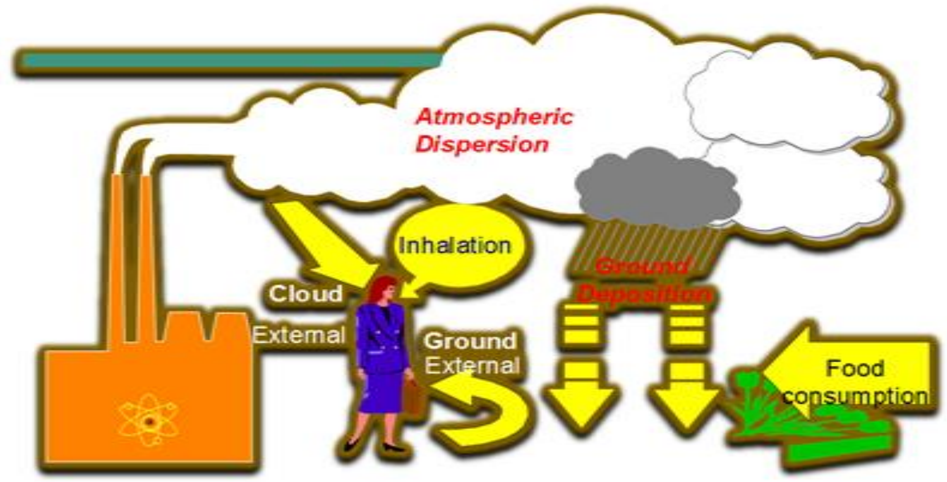
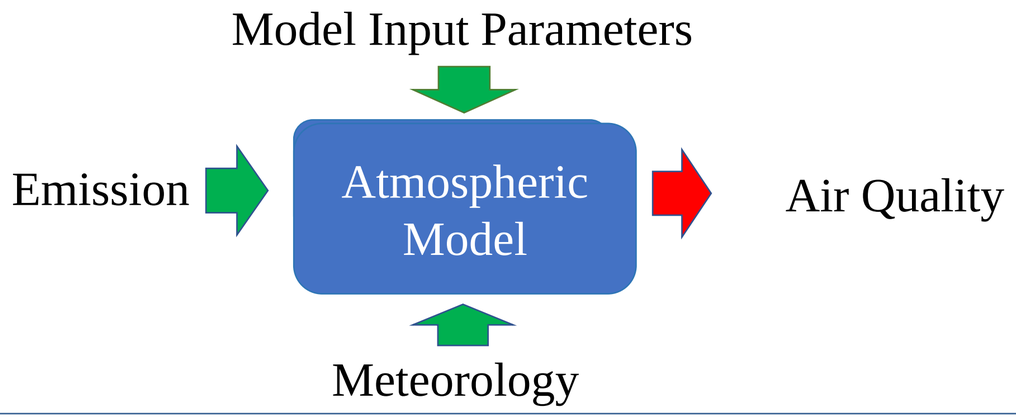


Fig. 1. Atmospheric dispersion of radionuclides from nuclear facilities.

Introduction

There are several types of dispersion model. But in radiological safety evaluation and emergency response, it is important to select how and which dispersion model can be used efficiently.

Relationship Between Emission to Air Quality



Gaussian Plume Model

Air Concentration

Gaussian plume model can be applied to predict air concentration.

$$\chi(x,y,z) = \frac{Q_i}{2\pi.\sigma_y.\sigma_z.u_a}.\exp\left(\frac{-y^2}{2\sigma_y^2}\right)\left\{\exp\left[\frac{(Z-H)^2}{2\sigma_z^2}\right]+\exp\left[-\frac{(Z+H)^2}{2\sigma_z^2}\right]\right\}$$

$$C_A = \frac{P_P F Q_i}{u_a}\exp\left(-\lambda_i \frac{x}{u_a}\right)$$

$$F = \frac{3}{\sqrt{2\pi^3}} \times \frac{\exp\left[-\left(\frac{H_{eff}^2}{2\sigma_z^2}\right)\right]}{x\sigma_z}$$

$$\sigma_z = E.x^G$$

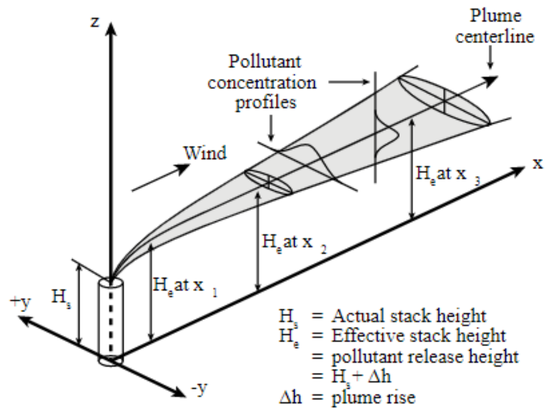


Fig. 2. Effective height calculation.

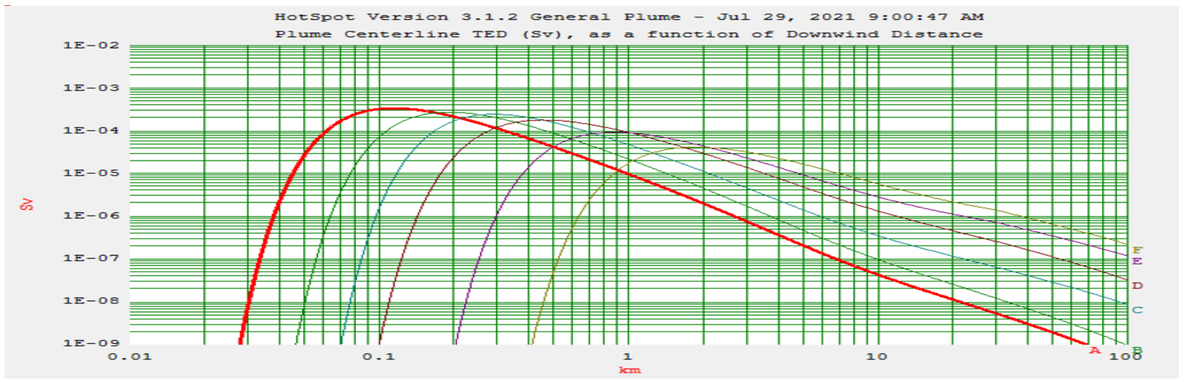
Effective Stack height

$$H_{eff} = H + D\left(\frac{v}{u}\right)^{1.4}\left(1+\frac{\Delta T}{T}\right)$$

Average wind speed at the effective stack height

$$u = u_z\left(\frac{H_{eff}}{z}\right)^m$$

HOTSPOT Output Based on GPM



Conclusion

Gaussian plume model is a very effective method in determining pollutant concentrations in atmosphere and widely used AQM to predict pollutant concentrations.

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