Explanation of Sample Problem
Continuous Emission of Air Pollutant

Problem Statement:
For the following data (that would be measured on site) manually calculate the downwind concentration profile for a distance of 1.5 km:

For varying Y, Z = 4
For varying Z, Y = 1.5

Height of pollutant release is 30.0 m
Stack exit velocity of gases is 0.80 m/sec
Wind speed is 0.80 m/sec
Inside stack diameter is 0.80 m
Atmospheric pressure is 1010 mbar
Stack gas temperature is 285 K
Atmospheric temperature is 280 K
The source rate of emission is 20. g/sec

The calculated effective height of release is calculated by

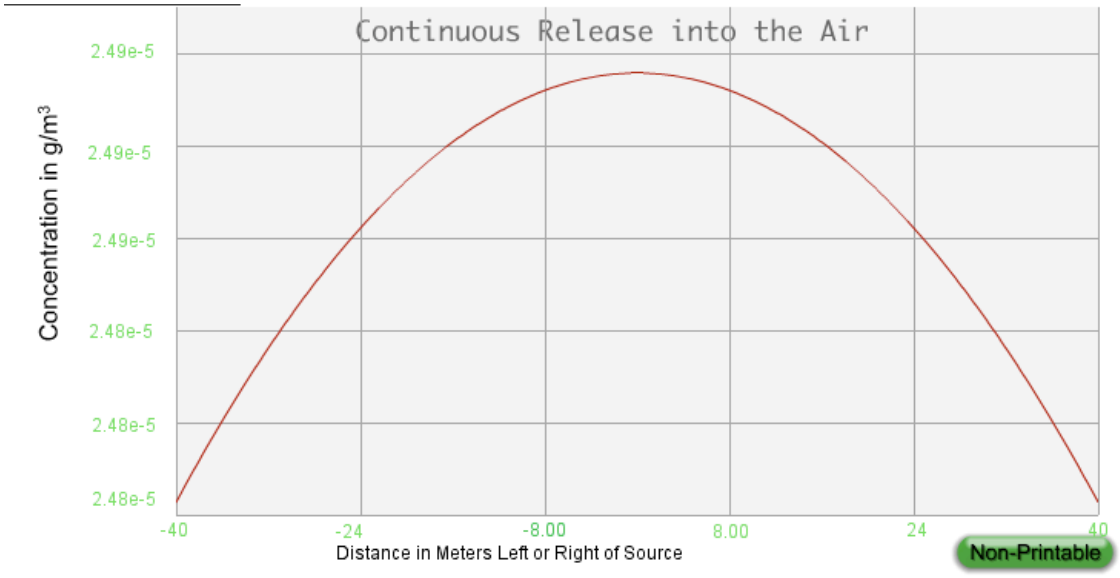
$$\Delta H_r = \frac{\bar{u}_s\, d}{u}\left(1.5 + 2.68 \times 10^{-3}\, P\, d\left(\frac{T_s - T_a}{T_s}\right)\right)$$

and results in an effective stack height of 31.2 m. Note that temperature must be in K.

The environmental data results in an atmospheric stability of condition A. Using the equations for dispersion or the figures, the horizontal dispersion is 298.2m and the vertical dispersion is 1.071×10^3m.

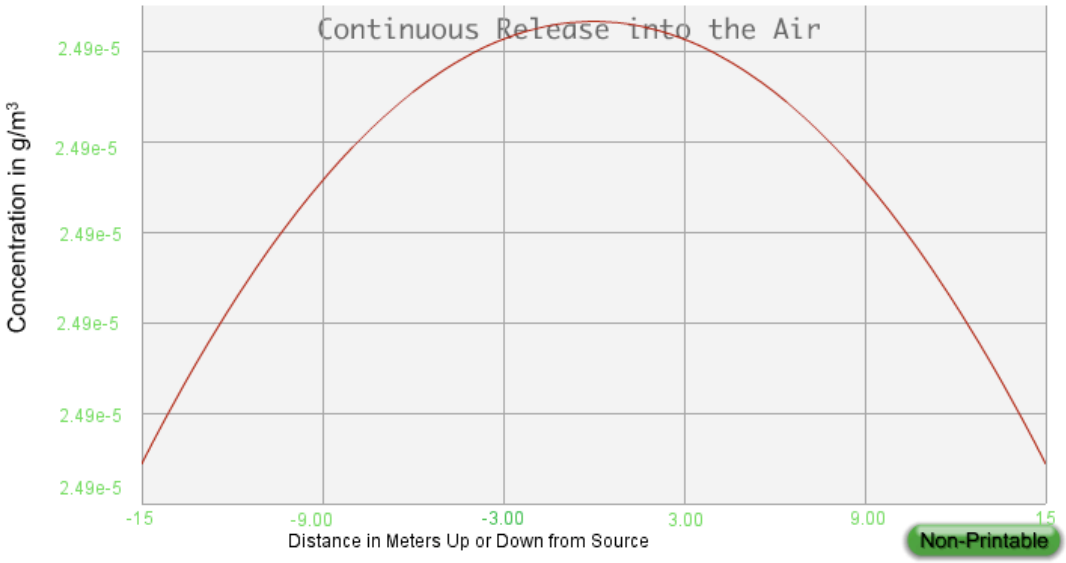
$$C(x,y,z) = \frac{Q_m}{2\pi\sigma_y\sigma_z u}\exp\left(-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right)\left[\exp\left(-\frac{1}{2}\left(\frac{z - H_r}{\sigma_z}\right)^2\right) + \exp\left(-\frac{1}{2}\left(\frac{z + H_r}{\sigma_z}\right)^2\right)\right] \qquad \text{Eqn 1}$$

Using the continuous fate and transport equation given above, the concentration profile (in g/m^3 versus m) for the plus and minus y direction is shown below



X =	1.5 km	Q_m =	20 g/Sec	∂_x =	298.2 m
Z =	4 m	$\bar{u}$ =	0.8 m/Sec	∂_z =	1.071e3 m
		H_r =	30 m		

The concentration profile for the z (height) directions is shown below



X = 1.5 km		Q_m = 20 g/Sec		∂_x = 298.2 m	
Y = 1.5 m		$\bar{u}$ = 0.8 m/Sec			
		H_r = 30 m		∂_z = 1.071e3 m	