Sharvil Shah
Advisor: Prof. Elif Kongar
Department of Technology Management, School of Engineering, University of Bridgeport, CT.

Abstract

The objective of this study is to explore / analyze and evaluate environmental tools and propose a tool that manages various environmental resources such as air, water, energy, land, mineral etc. The study is broadly classified into two categories. First step provides a background of the environmental issues while second step proposes a computer program tailored for environmental resource management. The focus of this study is to develop an environmental evaluation tool for engineers. This can be achieved with the help of the computer program or computational tools.

In environmental process design calculations are very complex in nature. The steps are repeated and it follows to the same procedure. The procedure when carried out manually is time consuming. Computer applications are proven to be useful for finding solutions due to their rapid computational ability and providing accurate results. It has shown its utility in all respects of computational work not only to save the time but also to give satisfactory accurate results. It has been accepted as one of the most efficient methods when dealing with the tedious calculations and complexity that an environment engineer has to face in real world.

Air Pollution Dispersing Modelling is a mathematical technique for predicting ambient air pollutant concentrations resulting from specific emissions. The SPM is the major pollutant from Sugar industry, application of GDM for only this parameter has been consider for case study. The modeling technique used to evaluate the GLC is summarized below.

The general equation to calculate the steady state concentration of an air contaminant in the ambient air resulting from a point source is given by:

$$C(x,y,z) = \frac{Q}{2 * \Pi * UH * \sigma y * \sigma z} * Exp\left(\frac{-y^2}{2 * \sigma y^2}\right) * Exp\left[\frac{-(z-H)^2}{2\sigma z^2}\right]$$

Where,

$C(x,y,z)$ = Pollutant concentration at the specified coordinate in $\mu g/m^3$
x = downwind distance along plume mean centerline from point source in m,
y = crosswind distance from the centerline of the plume in m,
z = vertical distance above ground in m,
Q = Pollutant emission rate in $\mu g/sec$,
u = wind velocity in downwind direction at effective stack height in m,

σy = lateral dispersion coefficient function in m,
σz = vertical dispersion coefficient function in m,
H = effective stack height in m,
h = physical stack height in m,
Δh = plume rise in m.
exp = base of neutral logs, 2.71828183
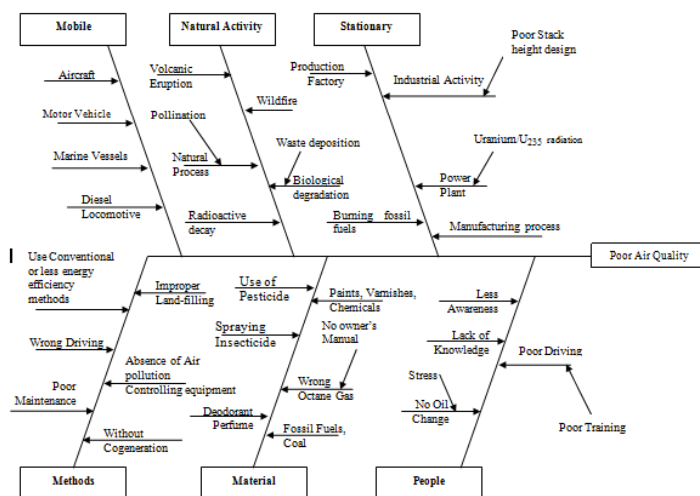
Ishikawa/Fishbone/ Cause and Effect Diagram
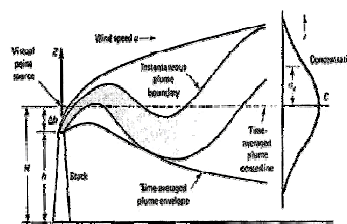
Plume Boundary and Time Averaged Envelope

Environmental engineer can explore the site for an industry. This is decided by knowing the possibility of SPM concentration at downwind distance from a particular industry. Engineer can forecast the Maximum GLC before installation of industry through the application of GDM & C# Programming.
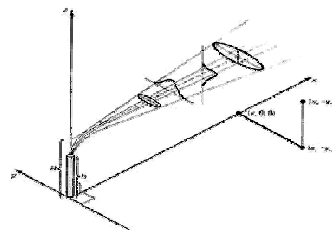
Coordinate System for Gaussian Plume Dispersion

Results and Conclusions

By using the Gaussian Dispersion model and C# programming we can see that we saved the time for Engineers. Such evaluation tools can help engineers and indirectly to the society by predicting the diffusion and dispersion magnitude in the spread area. Through this software we can control the affected area and restrict the human entry. We can estimate the travel time for pollutant and concentration of pollutant. This helps us for finding out which area is needed to be evacuated first. Most of the data collected and based on that with the help of Plausibility approach and Critical Wind Speed we can design the stack height in such away that the SPM concentration with the standards laid down by National Ambient Air Quality Standards such as 200µg/m3 for residential zone and thus ambient air quality will not be harmful to local people.

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