**Application of Numerical Weather Prediction Models in atmospheric dispersion studies**

The idealized meteorological as well as terrain conditions required by the regulatory atmospheric dispersion models never realizes in the real atmosphere. The atmospheric flow field is highly non-homogeneous and non-stationary even for a flat topographic conditions, and especially for complex or non-homogenous terrain conditions. The application of regulatory models, such as Gaussian Plume Model, under such conditions may give conservative estimate of the dispersion of pollutants, however, this could be far from the realistic assessment. Now a days, the Numerical Weather Prediction (NWP) Models are becoming popular choice for simulating 4-dimensional flow field conditions accounting for complex as well as non-homogeneous terrain conditions. Such NWP models can act as a meteorological driver to atmospheric dispersion models to account for complex flow conditions in atmospheric dispersion estimates. At present we are using CALMET/CALPUFF, Hysplit, and FLEXPART atmospheric dispersion models which can be driven by the 4-dimenaional atmospheric flow field generated by NWP models. In order to generate a test case results, the FLEXPART model was used with the flow field data generated using Weather Research and Forecasting Model, for a hypothetical release scenario. The deposited activity pattern in arbitrary units is shown in the following figure.

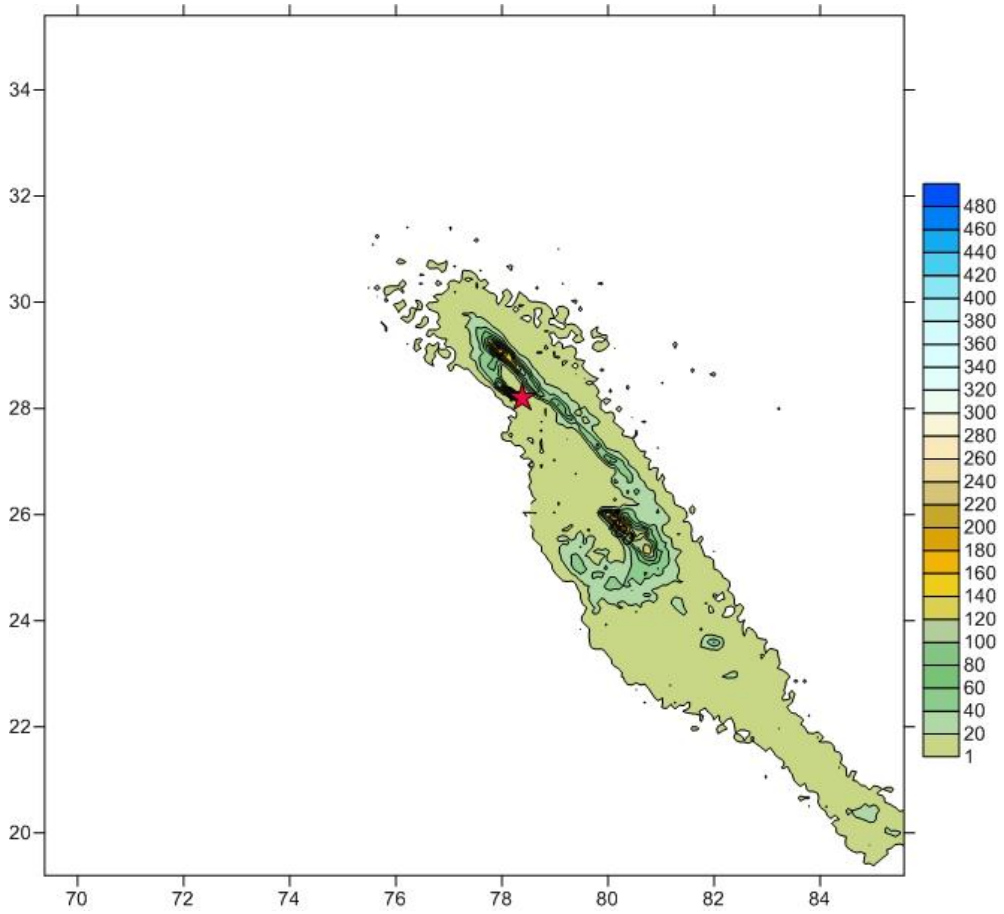


**Figure-3: Deposition pattern under completely non-homogeneous non-stationary meteorological condition for hypothetical release scenario using 4-dimensional meteorological data generated using NWP models**

**Application of NOAA Hysplit model for the simulation of atmospheric dispersion of pollutants**

HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Model is NOAA's hybrid model between Lagrangian and Eulerian approach to compute the pollutant air concentrations. It uses a large variety of meteorological model data, ranging from mesoscale to global scales, depending on the required scale of dispersion modelling.

**Simulation of atmospheric dispersion of styrene gas for Vizag**

Hysplit model was used to simulate the dispersion of styrene gas release from the LG Polymer Plant at Vizag. Due to the ambiguity in the total amount of styrene released from the plant, simulations were carried out for two different release quantities (3 tonnes and 600 tonnes) as reported in the press releases. The meteorological input was obtained from GDAS archives which is one of the operational systems run by NCEP. The grid resolution for the dispersion simulation was set at 0.001 deg (~ 110 m) for a domain size of 30 X 30 km around the source location. The starting time of emission is at 03 AM of 07$^{th}$ May (21:30 of 06$^{th}$ May UTC) and the model simulation ends at 03 AM of 08$^{th}$ May (21:30 of 07$^{th}$ May UTC). As the release is continuous, Gaussian approach is used in simulating the dispersion. It was observed that the wind direction was predominantly varying between S and WSW sectors due to which the villages falling between N and ENE sectors with respect to the LG Polymer Plant was affected. The villages within 5 km from the release point were worst affected. The maximum concentration for the release of 600 tonnes of styrene for 12.5 hours was found to be much higher than PAC3 values at locations closer to the release point. As expected, the locations and magnitude of maximum concentration varied according to the wind direction and wind speed. Such studies are useful in evaluating the impact of accidental releases. Figure-5 shows the concentration distribution at downwind distances from the plant as simulated by the Hysplit model.

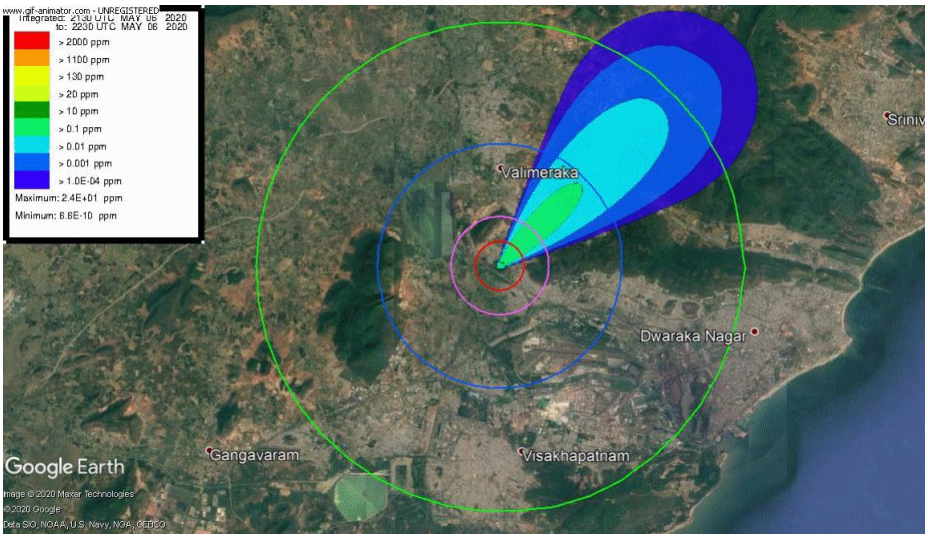


**Figure-5: Styrene concentration (ppm) around LG Polymer Plant**