A brief note on Air Dispersion Modelling of the Proposed Power Plant at Patenga, Chittagong

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Introduction

Dispersion models provide the ability to mathematically simulate atmospheric conditions and behaviour. They are used to calculate spatial and temporal sets of concentrations and particle deposition due to emissions from various sources. Dispersion models can be used to determine the affected zone around an emitter by producing results that can be compared against impact assessment criteria.

Dispersion models are widely used by environmental regulators in almost all the countries. The results have been shown, through numerous model evaluation studies, to be sufficiently robust to be relied on to calculate concentration limits for point-source stack emissions.

Background

As per terms of the project signed on 2 November 2011 between EPCV Chittagong Ltd. and Bangladesh Centre for Advanced Studies (BCAS) for the proposed 108 MW HFO-based power plant at Patenga in the district of Chittagong, an air dispersion modelling was completed to predict ground level concentrations (GLCs) of different pollutants (NOx, SO_2, CO, PM_{10}, $PM_{2.5}$) for the required averaging period across modelled domain (7.5km × 7.5 km around the stack). The project carried out till April 2012 (Three Months).

Model Selection

According to USEPA, AERMOD and ISC-PRIME (ISC3P) had a similar evaluation outcome for the full year Bowline Point data, featuring buoyant steam electric plant releases, with no significant differences in model performance. Since ISC3P requires a smaller suite of meteorological data inputs than AERMOD, **the former (ISC3P) has been selected for this project**.

Meteorological data requirement

For the ISC3P dispersion model, the meteorological parameters required are:

- wind speed (m/s)
- wind direction (°)
- ambient temperature (°K)
- atmospheric stability class
- mixing height (m).
- friction velocity (m/s)

- Monin-Obukhov length (m)
- surface roughness length (m)
- precipitation rate (mm/hr)
- solar radiation (W/m^2)

All parameters must be arranged as 1-hour average values as a minimum requirement.

Background air quality data and windroses for 6 months

To facilitate collection of background air quality data taking wind direction into consideration, six windroses for the year 2010 are given for the months January, March, May, July, September and November, covering 6 seasons of the year.

Summary of maximum GLCs over the model domain is given below:

Summary of predicted maximum GLCs over the model domain

Pollutant	Averaging period	DOE Bangladesh Std ($\mu g/m^3$)	Background conc ($\mu g/m^3$)	Predicted Maximum contribution by the plant ($\mu g/m^3$)	Combined value ($\mu g/m^3$)	% of DOE Std.
NO_2	24hr	150	21.65	42.57	64.22	42.81
SO_2	24hr	120	2.15	34.72	36.87	30.73
PM10	24hr	150	75.84*	1.85	77.69	51.79
PM2.5	24hr	65	19.83	-	-	-
CO	8hr	10.000	131**	2.87	133.87	1.34

* Background PM10 emission is dominated by the fugitive emission from the plant site. Emission from the power plant is predicted to be less than 1.5%.

** As local value is not available, literature value is used.

Impact Assessment and Summing Up

Modelling results indicate that emission around the power plant site during the operation of the plant will remain much below the DOE and WB standards. There will therefore, be no environmental and health hazard due to the operation of this 108 MW HFO-based power plant at the specified location of Patenga.