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Computer simulated versus observed NO_2 and SO_2 emitted from elevated point source complex

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ABSTRACT: ISC-AERMOD dispersion model was used to predict air dispersion plumes from an diesel power plant complex. Emissions of NO_2 and SO_2 from stacks (5 numbers) and a waste oil incinerator were studied to evaluate the pollutant dispersion patterns and the risk of nearby population. Emission source strengths from the individual point sources were also evaluated to determine the sources of significant attribution. Results demonstrated the dispersions of pollutants were influenced by the dominant easterly wind direction with the cumulative maximum ground level concentrations of 589.86 μg/m^3 (1 h TWA NO_2) and 479.26 μg/m^3 (1 h TWA SO_2). Model performance evaluation by comparing the predicted concentrations with observed values at ten locations for the individual air pollutants using rigorous statistical procedures were found to be in good agreement. Among all the emission sources within the facility complex, SESB-Power (diesel power plant) had been singled out as a significant source of emission that contributed >85% of the total pollutants emitted.

Key words: *ISC-AERMOD, plumes, diesel-fired, power plant complex, emission, stacks*

INTRODUCTION

Significant emissions of air pollutants, particularly in industrialised areas have always been a concern to in plant workers and nearby population in terms of air quality management. This is mainly due to the complexity of emissions sources, load of emissions, and type of emissions, variability of the local meteorological and terrain conditions as well as the presence of sensitive receptors in the surroundings of the air pollution sources. Air dispersion models (ADM) have been widely used to investigate the dispersion patterns and behaviour of air emissions in such areas (Mehdizadeh and Rifai, 2004), and also to assess the potential hazards to the human health (Zhou, *et al.*, 2003; James, *et al.*, 1995). ADMs are also used in air quality impact assessment on specific industrial facilities or a group of industry to assess the cumulative impact on the downwind pollutant concentrations and to predict future air quality in the surrounding for environmental management planning purposes. They are also used as a tool in environmental auditing exercises on the assessment audit of air quality impact as well as on the air pollution control efficiency on specific facilities. The model generated results could facilitate the respective authorities to make appropriate actions in accordance to the requirements of the relevant environmental laws and regulations. Point source emissions from various industrial sources have been the target for investigating the pollutants dispersion pattern by using various types of ADMs. For example, in power plants emission, ADMS 3.1 dispersion model had been used to model the dispersion of SO_2 (Carruthers, *et al.*, 1997; Bennet and Hunter, 1997; Carslaw and Beevers, 2002), ISCST3 dispersion model for CO and NO_x (Venegas and Mazzeo, 2005), and CALPUFF dispersion model for $PM_{2.5}$ and other gases (Zhou, *et al.*, 2003). Air dispersion model such as SCREEN was also used to study the dispersion of VOCs from various types of industries and their impact to the surrounding residential areas (James, *et al.*, 1995).

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MATERIALS AND METHODS

Locality of study area

The objectives of this study were to model or predict the maximum ground level concentrations of SO_2 and