IInt. J. Environ. Sci. Tech., 4 (1): 27-34, 2007
ISSN: 1735-1472


# Carbon monoxide levels along roadway

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Received 30 October 2006; revised 28 November 2006; accepted 7 December 2006; available online 1 January 2007

**ABSTRACT:** This paper predicts and compares the carbon monoxide (CO) concentration levels along Sembulan Road for years 2004 and 2014 using CAL3QHC air dispersion model at two major locations, i.e., at Sembulan Roundabout and Sutera Harbour Intersection, Kota Kinabalu, Sabah, Malaysia. The CO concentration "hot-spots" were also identified at Sutera Harbour Intersection, and the highest maximum 1-hr average ground level concentrations of CO modeled for Kpg. Air Sembulan located in the northeast of idling road was 9.33 ppm for year 2004. This study showed that there would be no extreme changes in CO concentration trends for year 2014 although a substantial increase in the number of vehicles is assumed to affect the level of CO concentrations. It was also found that the CO levels would be well below the Malaysian Ambient Air Quality Guidelines of 30 ppm for 1-hour Time-Weighted Average (TWA). Comparisons between the modeled and observed outputs using quantitative data analysis technique and statistical methods indicated that the CAL3QHC predicted results correlated well with measured data. It was predicted that receptors located near to the major intersection, in the long-term would be potentially exposed to relatively higher CO levels.

**Key words:** *Carbon monoxide, air dispersion model, maximum 1 h average, intersections*

## INTRODUCTION

Transportation activities have been identified as a single major source of air pollution in urban areas (Mukherjee and Viswanathan, 2001) with subsequent adverse human health effects (Chan, *et al.,* 2002; Colvile, *et al.,* 2001). Similarly with other developing cities, commercial areas in Kota Kinabalu city attract and generate relatively large volumes of traffic, particularly during rush hours that typically circulates at low speeds with frequent stops and starts. This traffic pattern produces relatively high CO emissions. Since commercial areas also attract large numbers of people, the potential for human exposure is relatively high. Sensitive stationary receptors within the city's commercial area such as schools, residential flats and apartments and other public places also become a concern on the effect of traffic related emissions on populations' health and the local environment. Motor vehicles as a combined emission source make a significant contribution to the atmospheric pollution inventory; that contributed over 90% of CO emission in the urban area (Hasnah, *et al.,* 2000). The CO levels have always been the target of investigation in most monitoring and modeling studies concerning vehicular pollution near roadways and major intersections in many cities (Bogo, 1999; Moseholm, 1996). CO is the result of incomplete fuel combustion that characterize mobile as opposed to stationary pollution sources and therefore it can be used as an indicator for the contribution of traffic to air pollution (Comrie and Diem, 1999). Study of air quality problems at micro-scale urban environment requires application of an adequate methodology that permits to understand source-receptor relationship and to develop a proper strategy to reduce atmospheric pollution (James, 2002). Air dispersion models have been widely used to address this issue by providing invaluable information for better and more efficient air quality planning. For example, line source models are used to simulate the dispersion of pollutants near highways where vehicles are continually emitting pollutants. In present work, CAL3QHC dispersion model was used to model and predict CO levels along Sembulan Road in Kota Kinabalu city center for year 2004 and 2014. The objective was to identify CO hot-spots during typical

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