

5.36 ATMOSPHERIC DISPERSION OF NITROGEN OXIDES RELEASED FROM COGENERATION SYSTEMS IN URBAN AREAS

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More than 3,850 cogeneration systems have been introduced as energy-saving equipment for both commercial and industrial uses since the 1980's in Japan. Cogeneration systems produce not only electric power but also heat. The heat produced when energy is generated can be used for hot water supply and air conditioning, so cogeneration systems are located near the site where the heat is required. Almost all of the cogeneration systems operate by internal combustion such as gas turbines, gas engines and diesel engines that burn fossil fuel and so the exhaust gases from cogeneration systems contain NO_x emissions. Air quality impacts taking into account the building downwash must therefore be considered because many cogeneration systems have stacks that are lower than the nearby building height in urban areas. In this study, a steady-state Gaussian plume model based of Industrial Source Complex Dispersion Model (ISC3) of US EPA was used to estimate the effect of emission of pollutants from cogeneration systems on ambient concentrations of pollutants in the metropolis of Tokyo. Source input data (e.g., location, emission rate, and physical stack height) for emission inventories were obtained from results of a questionnaire survey of commercial and industrial customers within the Tokyo metropolitan area and catalogs of individual cogeneration systems. Building dimensions (widths and heights) for use with the model in downwash analyses were obtained automatically from Geophysical Information Systems (GIS). We calculated hourly concentrations of nitrogen oxides based on hourly meteorological data and averaged the hourly concentrations over a year. Calculated yearly averaged ground level concentration of NO_x released from cogeneration systems in urban areas of Tokyo was estimated to be 10% or less of ambient air concentrations.