Modeling Airborne Emissions and Health Risks from Port-Based Cement Industry Activities

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Abstract

The rapid growth of industrial and transportation activities has led to a significant increase in air pollution, especially in cement production areas. This study aimed to assess public health risks in the coastal region of Pangkajene Regency, Indonesia, due to air pollutants emitted from a port dedicated to cement factory operations. A quantitative descriptive approach was used, involving data collection, field measurements, and spatial analysis. AERMOD software was employed to model the spatial distribution of Total Suspended Particulates (TSP) and Nitrogen Oxides (NOx). This was followed by an environmental health risk assessment for communities living near the cement port facilities. The modeling revealed maximum concentrations of 60 $\mu g/m^3$ for TSP and 500 $\mu g/m^3$ for NO_2. The dispersion of these pollutants was primarily toward the northeast, shaped by prevailing wind patterns and the characteristics of the emission sources. The health risk assessment showed that long-term exposure (over 15 years) to TSP and NOx results in a Risk Quotient (RQ) exceeding 1, indicating a potential for non-carcinogenic health effects. These results emphasize the urgent need for improved emission control strategies and targeted protection for at-risk populations. They also highlight the importance of stricter environmental regulations to reduce health impacts from industrial port activities.

Keywords: Environmental Pollutants; Airborne Emissions; Public Health, Cement Industry; Risk Assessment.