ABSTRACT

CO2 Exposure and Physiological Responses among Manggar Landfill Workers: An Environmental Health Risk Assessment

Vivi Filia Elvira, Morrin Choirunnisa Thohira,
Ayudhia Rachmawati, Muhammad Aidil Fitrah, Syamsir

Correspondence E-mail : vivifiliaelvira@gmail.com

Background : Exposure to carbon dioxide (CO_2) in landfill environments may affect workers' physiological responses due to gases generated during organic waste decomposition.

Objective : This study aimed to assess the environmental health risks associated with CO_2 exposure among workers at Manggar Landfill, Balikpapan City, using the Environmental Health Risk Assessment (EHRA) approach.

Research Methods/ Implementation Methods : An analytic observational study was conducted involving 40 landfill workers. CO_2 concentrations were measured using a real-time direct-reading instrument, accompanied by measurements of meteorological parameters and assessments of workers' physiological responses. Health risk was estimated by calculating the Risk Quotient (RQ) for different exposure durations.

Results : The results showed that CO_2 concentrations ranged from 380 to 430 ppm and tended to increase under conditions of low wind speed (1.94 m/s), relatively stable temperature (29–31°C), and high relative humidity (74–75%). The real-time RQ was 0.076, while the projected RQ values for 10 and 20 years of exposure were 0.426 and 0.776, respectively, indicating no appreciable non-carcinogenic risk (RQ < 1).

Conclusion/Lesson Learned : However, the projected 30-year RQ reached 1.126, indicating a potential non-carcinogenic health risk from long-term occupational exposure. These findings highlight the importance of regular air quality monitoring, exposure-duration management, and appropriate occupational health measures to minimize long-term CO_2 exposure among landfill workers.

Keyword : Environmental Health Risk Assessment; CO_2; Landfill; Occupational Health; Workers; Meteorology

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