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Health Risk Assessment of Exposing to Benzene in Office Building around a Chemical Industry Based on Numerical Simulation

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Abstract : Releasing hazardous chemicals is one of the major problems for office buildings in the chemical industry and, therefore, environmental risks are inherent to these environments. The adverse health effects of the airborne concentration of benzene have been a matter of significant concern, especially in oil refineries. The chronic and acute adverse health effects caused by benzene exposure have attracted wide attention. Acute exposure to benzene through inhalation could cause headaches, dizziness, drowsiness, and irritation of the skin. Chronic exposures have reported causing aplastic anemia and leukemia at the occupational settings. Association between chronic occupational exposure to benzene and the development of aplastic anemia and leukemia were documented by several epidemiological studies. Numerous research works have investigated benzene emissions and determined benzene concentration at different locations of the refinery plant and stated considerable health risks. The high cost of industrial control measures requires justification through lifetime health risk assessment of exposed workers and the public. In the present study, a Computational Fluid Dynamics (CFD) model has been proposed to assess the exposure risk of office building around a refinery due to its release of benzene. For simulation, GAMBIT, FLUENT, and CFD Post software were used as pre-processor, processor, and post-processor, and the model was validated based on comparison with experimental results of benzene concentration and wind speed. Model validation results showed that the model is highly validated, and this model can be used for health risk assessment. The simulation and risk assessment results showed that benzene could be dispersion to an office building nearby, and the exposure risk has been unacceptable. According to the results of this study, a validated CFD model, could be very useful for decision-makers for control measures and possibly support them for emergency planning of probable accidents. Also, this model can be used to assess exposure to various types of accidents as well as other pollutants such as toluene, xylene, and ethylbenzene in different atmospheric conditions.

Keywords : health risk assessment, office building, Benzene, numerical simulation, CFD
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