

Article

Numerical Simulation of Dispersion Patterns and Air Emissions for Optimal Location of New Industries Accounting for Environmental Risks

Ali Bscibsu ¹, Chandra Mouli R. Madhuranthakam ² , Kaan Yetilmezsoy ^{3,*}, Ali Almansoori ⁴
and Ali Elkamel ^{1,4} 

¹ Department of Chemical Engineering, University of Waterloo, Waterloo, ON N2L 3G1, Canada

² Department of Chemical Engineering, Abu Dhabi University, Abu Dhabi P.O. Box 59911, United Arab Emirates

³ Department of Environmental Engineering, Faculty of Civil Engineering, Yıldız Technical University, Davutpaşa, Esenler, 34220 Istanbul, Turkey

⁴ Department of Chemical Engineering, Khalifa University, Abu Dhabi P.O. Box 127788, United Arab Emirates

* Correspondence: kyetilmezsoy@gmail.com

Abstract: One of the main reasons for air pollution is industrial plants releasing huge amounts of air pollutants in the form of gas emissions. The different chemical pollutants and their corresponding levels present in these emissions, and their proximity to the industrial source, have serious effects on the nearby ecosystems. Some of the industrial nuisances include noise, smoke, dirt, dust, odor and noxious gases, which have to be minimized (if possible, eliminated), especially if the location is desired to be used as a community site. When choosing locations at which to build either new industrial plants or new community sites, software can be used to assess both the short-term and long-term concentration profiles of the various detrimental air pollutants. In this study, the AERMOD model was used to find an optimal location to build a new plant in Toledo, Ohio, USA. Simulations were performed to study the pollutant emissions and their dispersion patterns for four different geographic locations situated away from an existing plant in this region. The AERMOD model, along with the IRAP-h View model, which is approved by the US Environmental Protection Agency (EPA), has been successfully used to assess the fate and transport of pollutants from the proposed new industrial plants. The hazard quotients from the analysis of the results for these four different geographic locations were assessed. The highest total non-cancer hazard indices of 18.7 and 13.2 were obtained for fisher adult and fisher child, respectively, in one of the four locations. The acute inhalation quotient risk was less than the target hazard index of 0.25 for all the four locations. With respect to the concentrations of several chemicals of potential concern (COPC), such as soil, produce, beef, chicken, milk and pork, the fourth location (farthest east) recorded the minimum range values compared to the other three locations.

Keywords: AERMOD; air pollution; dispersion; environmental risks; optimization; simulation

1. Introduction

Among the different types of pollution, gas emissions originating from industrial sources can be considered as a major source of air pollution. Pollutants in these emissions have a major impact on the ecosystems close to the industrial sources. Some of the common air pollutants include gases (e.g., SO_x, NO_x, CO, HC_x, volatile organic compounds, etc.), particulate matter (e.g., smoke, dust, ash, fumes, aerosols, pollen), radioactive materials and many others. Industrial activities, such as oil refining, the production of specialty chemicals, fertilizers, organic and inorganic chemicals and power generation, contribute to a significant share of the overall air pollution. Study of the dispersion of these air pollutants into the air, water and soil is important not only for the planning of new premises for communities but also for building new industrial plants. The detrimental effects of pollutant gases that are



Citation: Bscibsu, A.; Madhuranthakam, C.M.R.; Yetilmezsoy, K.; Almansoori, A.; Elkamel, A. Numerical Simulation of Dispersion Patterns and Air Emissions for Optimal Location of New Industries Accounting for Environmental Risks. *Pollutants* **2022**, *2*, 444–461. <https://doi.org/10.3390/pollutants2040050>

Academic Editor: Tony Robert Walker

Received: 7 September 2022

Accepted: 18 October 2022

Published: 2 November 2022

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Optimal Patterns Of Location

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