



Article

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

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**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 EPA-6th 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.,  $SO_2$ ,  $NO_x$ ,  $CO$ ,  $HCl$ ), 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



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# Optimal Patterns Of Location

**Åke E. Andersson, Magnus Holm, Bertil  
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## **Table of Contents Optimal Patterns Of Location**

1. Understanding the eBook Optimal Patterns Of Location
  - The Rise of Digital Reading Optimal Patterns Of Location
  - Advantages of eBooks Over Traditional Books
2. Identifying Optimal Patterns Of Location
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Optimal Patterns Of Location
  - User-Friendly Interface
4. Exploring eBook Recommendations from Optimal Patterns Of Location

- Personalized Recommendations
- Optimal Patterns Of Location User Reviews and Ratings
- Optimal Patterns Of Location and Bestseller Lists

5. Accessing Optimal Patterns Of Location Free and Paid eBooks

- Optimal Patterns Of Location Public Domain eBooks
- Optimal Patterns Of Location eBook Subscription Services
- Optimal Patterns Of Location Budget-Friendly Options

6. Navigating Optimal Patterns Of Location eBook Formats

- ePub, PDF, MOBI, and More
- Optimal Patterns Of Location Compatibility with Devices
- Optimal Patterns Of Location Enhanced eBook Features

7. Enhancing Your Reading Experience

- Adjustable Fonts and Text Sizes of Optimal Patterns Of Location
- Highlighting and Note-Taking Optimal Patterns Of Location
- Interactive Elements Optimal Patterns Of Location

8. Staying Engaged with Optimal Patterns Of Location

- Joining Online Reading Communities
- Participating in Virtual Book Clubs
- Following Authors and Publishers Optimal Patterns Of Location

9. Balancing eBooks and Physical Books Optimal Patterns Of Location

- Benefits of a Digital Library
- Creating a Diverse Reading Collection Optimal Patterns Of Location

10. Overcoming Reading Challenges

- Dealing with Digital Eye Strain
- Minimizing Distractions
- Managing Screen Time

11. Cultivating a Reading Routine Optimal Patterns Of Location

- Setting Reading Goals Optimal Patterns Of Location
- Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Optimal Patterns Of Location

- Fact-Checking eBook Content of Optimal Patterns Of Location
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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