Modeling Dispersion of PM_{10} for a Steel Billet and Pipe Production Plant Using AERMOD: (A Case Study: Ashtian County)

Introduction: This study focuses on modeling the dispersion of particulate matter (PM_{10}) emissions from a proposed steel billet and pipe production plant in Ashtian County, Iran, using the AERMOD dispersion model. Air pollution, particularly from particulate matter, poses significant health risks, including respiratory and cardiovascular diseases, due to the particles' ability to penetrate deep into the lungs and enter the bloodstream. The research aims to assess the environmental impact of the proposed industrial project by predicting the dispersion and concentration of PM~10~ emissions in the surrounding area.

Material and Methods: The AERMOD software, a widely used tool for air quality modeling, was employed to simulate the dispersion of PM_{10}. The model utilizes meteorological data, a digital elevation model, and information about pollution sources to predict pollutant concentrations at specific locations. The study area, located in Ashtian County, covers approximately 2116 square kilometers, with the proposed plant situated near the city of Ashtian and several surrounding villages. Meteorological data from the Ashtian Synoptic Station, collected over five years, were used to inform the model, along with topographical maps and satellite imagery.

Results and Discussion: The results of the dispersion modeling indicated that the maximum 24-hour concentration of PM_{10} was 47.9 micrograms per cubic meter, which is significantly below the Iranian air quality standard of 150 micrograms per cubic meter. Similarly, the maximum annual concentration of PM_{10} was found to be 34.4 micrograms per cubic meter, also well below the annual standard. These findings suggest that the proposed project, in terms of PM_{10} emissions, will not pose a significant threat to air quality in the region. The dispersion of PM_{10} was primarily concentrated near the plant's emission source, with concentrations decreasing rapidly as distance from the source increased. The dominant wind patterns and meteorological conditions in the area played a crucial role in the dispersion of pollutants. The study also highlighted the importance of using advanced modeling tools like AERMOD for environmental impact assessments of industrial projects. The model's ability to simulate pollutant dispersion under various meteorological and topographical conditions makes it a valuable tool for predicting air quality impacts and informing decision-making processes.

Conclusion: In conclusion, the research demonstrates that the proposed steel billet and pipe production plant in Ashtian County is unlikely to exceed air quality standards for PM10 emissions. The findings underscore the importance of using accurate and reliable modeling tools to assess the environmental impacts of industrial projects, particularly in regions with sensitive ecosystems and populations. The study recommends further monitoring and validation of air quality data once the plant becomes operational, as well as the implementation of additional pollution control measures, such as advanced filtration systems and green belts, to further mitigate any potential environmental impacts. This research contributes to the growing body of literature on air quality modeling and provides valuable insights for policymakers and environmental managers in assessing the impacts of industrial activities on air quality.

Keywords: Quantification, Air pollution, Particulate Matter, AERMOD.