# Air Quality Index (AQI) Analysis - Delhi, January 2023

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## 1. Introduction

Air quality is a critical environmental and public health concern. The Air Quality Index (AQI) provides a standardized numerical value representing the overall air quality, helping authorities and citizens understand pollution levels and take necessary action.

Objective:

- Analyze the air quality in Delhi during January 2023.

- Identify trends in pollution over time.

- Understand which pollutants contribute most to poor air quality.

- Provide insights to mitigate health risks.

## 2. Problem Statement

Delhi experiences significant air pollution, especially in winter months. High levels of particulate matter and gaseous pollutants adversely affect public health.

The challenges addressed in this project include:

- Calculating AQI based on multiple pollutants.

- Identifying patterns in air quality over hours, days, and weeks.

- Understanding correlations between pollutants to identify major contributors.

## 3. Dataset

The dataset contains hourly air quality measurements from Delhi during January 2023, including:

- date: Date and time of measurement

- co: Carbon Monoxide (µg/m3)

- no: Nitric Oxide (µg/m3)

- no2: Nitrogen Dioxide (µg/m3)

- o3: Ozone (µg/m3)

- so2: Sulfur Dioxide (µg/m3)

- pm2_5: Particulate Matter 2.5 (µg/m3)

- pm10: Particulate Matter 10 (µg/m3)

- nh3: Ammonia (µg/m3)

## 4. Methodology

The analysis was performed using Python, following these steps:

1. Data Cleaning and Preprocessing: Handling missing values, converting timestamps, and ensuring consistent data types.

2. AQI Calculation: Computing AQI values based on pollutant concentrations and categorizing them into standard levels.

3. Time-Series Analysis: Examining hourly, daily, and weekly trends to identify peak pollution times.

4. Correlation Analysis: Assessing relationships between pollutants to identify major contributors.

5. Insight Generation: Drawing actionable conclusions for public health and pollution mitigation.

## 5. Findings

- Air quality in Delhi during January 2023 was predominantly unhealthy, with very few days classified as Good or Moderate.

- Peak pollution occurred during early mornings and evenings.

- Weekly analysis showed that Wednesdays and Thursdays had worse air quality than other days.

- PM2.5 and PM10 were the major contributors to AQI, showing the strongest correlation with overall pollution.

## 6. Proposed Solution / Recommendations

- Authorities should monitor PM2.5 and PM10 levels closely and issue alerts on high pollution days.

- Public awareness campaigns to limit outdoor activity during peak pollution hours.

- Implement policies to reduce emissions from vehicles, industries, and construction, especially mid-week.

- Encourage use of air purifiers and masks in high-risk areas during winter months.

## 7. Tools and Libraries

- Python: Pandas, NumPy for data processing.

- Visualization: Matplotlib, Seaborn for charts.

- Analysis Techniques: Time-series analysis, correlation analysis, AQI computation.

## 8. Conclusion

This project analyzed Delhi's air quality in January 2023, identifying patterns, peak pollution times, and major contributing pollutants. The insights can inform public health interventions and policy decisions aimed at reducing exposure to hazardous air pollutants.