Guangzhou Air Quality Analysis (2015–2024)
Power BI Final Project – Insight Report
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1. Introduction & Business Objective

Air quality has emerged as a critical environmental and public health priority in China's major cities, exacerbated by rapid urbanization, energy consumption, and industrial activity. As one of southern China's largest metropolitan hubs, Guangzhou faces persistent air quality challenges driven by vehicle emissions, industrial processes, and seasonal meteorological shifts.

Objective: This project leverages Power BI to analyze 584 historical air quality records (sourced from Kaggle, extracted from a ~3,000-row national dataset) to:

Track AQI (Air Quality Index) trends in Guangzhou between 2015–2024

Identify key pollutants driving poor air quality

Explore correlations between AQI and meteorological factors (temperature, humidity)

Deliver data-driven insights to support policymakers, environmental agencies, and urban planners in designing targeted pollution control strategies

2. Data Preparation & Methodology

2.1 Data Cleaning (Power Query)

Filtered to retain only Guangzhou records (584 rows)

Standardized data types (pollutants/weather: Decimal Number; Year/Month: Whole Number; City/Season: Text)

Removed empty rows, duplicates, and inconsistencies

Created a conditional AQI Category column (Good/Moderate/Unhealthy/Very Unhealthy/Hazardous) per standard thresholds

Calculated core measures: Average AQI, Unhealthy Days, Average PM2.5, Total Precipitation, AQI Standard Deviation

2.2 Data Modeling & Visualization

Built a Date Table for time-series analysis (linked to dataset's Date field)

Designed an interactive dashboard with:

KPI cards (Average AQI, Unhealthy Days, Average PM2.5)

AQI trend line (2015–2024)

Pollutant comparison bar chart (PM2.5, PM10, NO2, SO2)

Scatter chart (AQI vs Temperature; bubble size = Humidity; color = AQI Category)

Seasonal heatmap (Year × Month AQI)

AQI category distribution pie chart

Slicers for Year, Month, and Season

3. Key Insights & Recommendations

Insight 1: Seasonal Fluctuations Dominate AQI—Winter/Early Spring Are Peak Pollution Periods

The Year–Month heatmap and trend line confirm consistent AQI spikes in January–March (Q1) across years. This aligns with regional patterns: lower temperatures, weak atmospheric dispersion, and increased heating-related emissions in surrounding areas drive elevated PM2.5/PM10 levels. Conversely, June–August (Q3) sees the cleanest air, supported by heavy rainfall and strong atmospheric circulation.

Recommendation: Intensify monitoring and targeted controls (e.g., traffic restrictions, industrial inspections) during Q1 to mitigate peak pollution.

Insight 2: PM2.5 and PM10 Are Primary AQI Drivers

Pollutant comparison charts show PM2.5 and PM10 have significantly higher average concentrations than NO2 and SO2. "Unhealthy/Very Unhealthy" days directly correlate with PM2.5 spikes, and high AQI variability (per Standard Deviation) indicates occasional severe pollution events linked to particulate matter.

Recommendation: Prioritize policies to reduce particulate matter—strengthen vehicle emission standards, control construction dust, and monitor industrial combustion sources.

Insight 3: Temperature and Humidity Shape AQI Dynamics
A weak negative correlation exists between temperature and AQI (higher temperatures = better air quality, consistent with summer trends).
High humidity (bubble size in scatter chart) increases AQI variability: warm, humid conditions can facilitate secondary aerosol formation, worsening pollution on select days.

Recommendation: Integrate temperature and humidity into air quality forecasting models to improve pollution event predictions and public health advisories.

Insight 4: Most Days Are “Good/Moderate,” but Unhealthy Days Persist
The pie chart shows “Good” and “Moderate” days account for the majority of observations, reflecting overall air quality improvement. However, a meaningful share of days remains “Unhealthy” or worse, indicating recurring pollution spikes that require intervention.
Recommendation: Investigate root causes of Q1 pollution events and strengthen preventive measures to reduce episodic poor air quality.

4. Conclusion

This Power BI analysis delivers a holistic view of Guangzhou’s air quality (2015–2024), highlighting seasonal patterns, pollutant drivers, and meteorological influences. The interactive dashboard empowers stakeholders to explore data dynamically and inform evidence-based decisions for environmental planning, public health protection, and pollution control.
Future Work: Extend analysis with forecasting models, multi-city comparisons, or policy impact evaluations using expanded datasets.