

# Air Pollution: Evidence from the Gulf Environmental Partnership and Action Program


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This note is the first in the GCC Knowledge Notes aimed to promote debate, discussion and dissemination of knowledge for the most pertinent development questions the GCC region faces. It is based on the Pollution Load Assessment reports for Bahrain, Kuwait, and Qatar prepared as part of the Gulf Environmental Partnership and Action Program national activities led by Helena Naber and Samia Al-Duaij, with Sarath Guttikunda, Director, UrbanEmissions.Info as lead author. The author would like to thank Maria Vagliasindi, GCC SD Program Leader, Benoit Blarel, MNA Environment Practice Manager, and Nadir Mohammed, GCC Country Director, for their overall guidance, Maria Sarraf for chairing the Brown Bag Breakfast (BBB) which was held on December 1, 2015, Yewande Awe, Sameer Akbar and Ziad Nakat for leading the BBB discussion, and Bank participants from Riyadh, Kuwait and Washington, DC, for their most helpful comments.



# Air Pollution: Evidence from the Gulf Environmental Partnership and Action Program

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## Key Messages

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- Air pollution is a significant cause of death and disease, and associated productivity losses.
- Air pollution load assessments were carried out with the environmental agencies in Kuwait, Bahrain, and Qatar, as part of the Gulf Environmental Partnership and Action Program to identify key challenges and solutions.
- Detailed technical models showed that vehicles and power generation are the major sources for the fine PM emissions while re-suspended dust dominates for the coarse particulate matter emissions.
- Common challenges identified include: natural dust as a key pollutant, followed by refineries, power plants, desalination units, transport (road and shipping); limited monitoring activities; lack of a common air quality index methodology in the Gulf Cooperation Council (GCC) region; and lack of a common data assimilation platform.
- Strengthening of the national air quality management systems should allow countries to approach the issue through collaboration and regional programs.
- The recently submitted Intended Nationally Determined Contribution (INDC) by all GCC countries provides a golden opportunity to further explore both at the sectoral and cross sectoral level opportunities to strengthen our current engagement.

## Introduction

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**A**ir quality is at the nexus of health, energy, transport and environmental issues. Air pollution is a significant cause of death and disease and associated productivity losses. It ranks amongst the highest environmental burdens to health according to the Global Burden of Disease Study and the World Health Organization, with some potential for underestimation through a lack of quantification for effects of NO<sub>2</sub> and long-term exposure to ozone, in particular. For example, in Bahrain, Kuwait, and Qatar, the GBD estimates 773 deaths annually due to PM<sub>2.5</sub>. The chief source of CO<sub>2</sub> is the combustion of the same fuels that also generate emissions of SO<sub>2</sub>, NO<sub>x</sub> and fine particles. Accordingly, the co-benefits of reduced emissions of air pollutants may even exceed the costs of

greenhouse gas controls, with the added attraction that these benefits tend to accrue in the short term to those reducing emissions.

As part of the Gulf Environmental Partnership and Action Program national activities phase, air pollution load assessments (PLA) were conducted in Bahrain, Kuwait, and Qatar in 2012–13. The aim of the PLA was to understand the spatial and temporal spread of air emissions from all known sources, which can be further integrated into the environmental monitoring and auditing systems in the three countries. This knowledge note provides an overview of the results of these efforts, the missing links, and discuss the proposed way forward for future engagements.

## Analytical Framework and Key Results

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The PLA program was designed to quantify the total load of air emissions and their contributions to the ambient air pollution in each country, as a first step in designing the necessary technical capabilities to address the air quality management issues and to further inform decision making.

Detailed technical models (emissions and dispersion modeling) were carried out with the environmental authorities of the three GCC countries (see Box 1). The PLA complemented the cost of environmental degradation studies in the three countries, which highlighted that significant portion of the environmental damages are from air pollution, in the form of health impacts.

Results showed that vehicles and power generation are the major sources for the fine PM emissions (PM<sub>10</sub> and PM<sub>2.5</sub>), while re-suspended dust dominates for the coarse particulate matter emissions (>PM<sub>10</sub>). The emission sources

for SO<sub>2</sub>, NO<sub>x</sub>, VOC, and CO are mixed, with the industries, refineries, and power generation sectors dominating.

Some of the common challenges across the three countries that were identified include:

- Natural dust as a key pollutant, followed by refineries, power plants, desalination units, transport (road and shipping)
- Diesel and heavy oil as major combustion fuels, leading to nodal NO<sub>2</sub>, VOC, and ozone pollution
- High sulfur content in the diesel (above 2000ppm) at power plants and road transport
- Limited monitoring activities
- Lack of a common air quality index (AQI) methodology in the GCC region
- Lack of a common data assimilation platform

## Lessons Learned and Way Forward

The PLA provides a sound foundation for designing and undertaking further actions to manage air quality in the GCC region. Alternative interventions to control particulate matter pollution should be ranked based on the estimation of costs and benefits associated with the prevention or reduction of disease and mortality through implementation of such interventions.

Several actions and studies may be undertaken to strengthen the established capacity to address air quality in the GCC region, including:

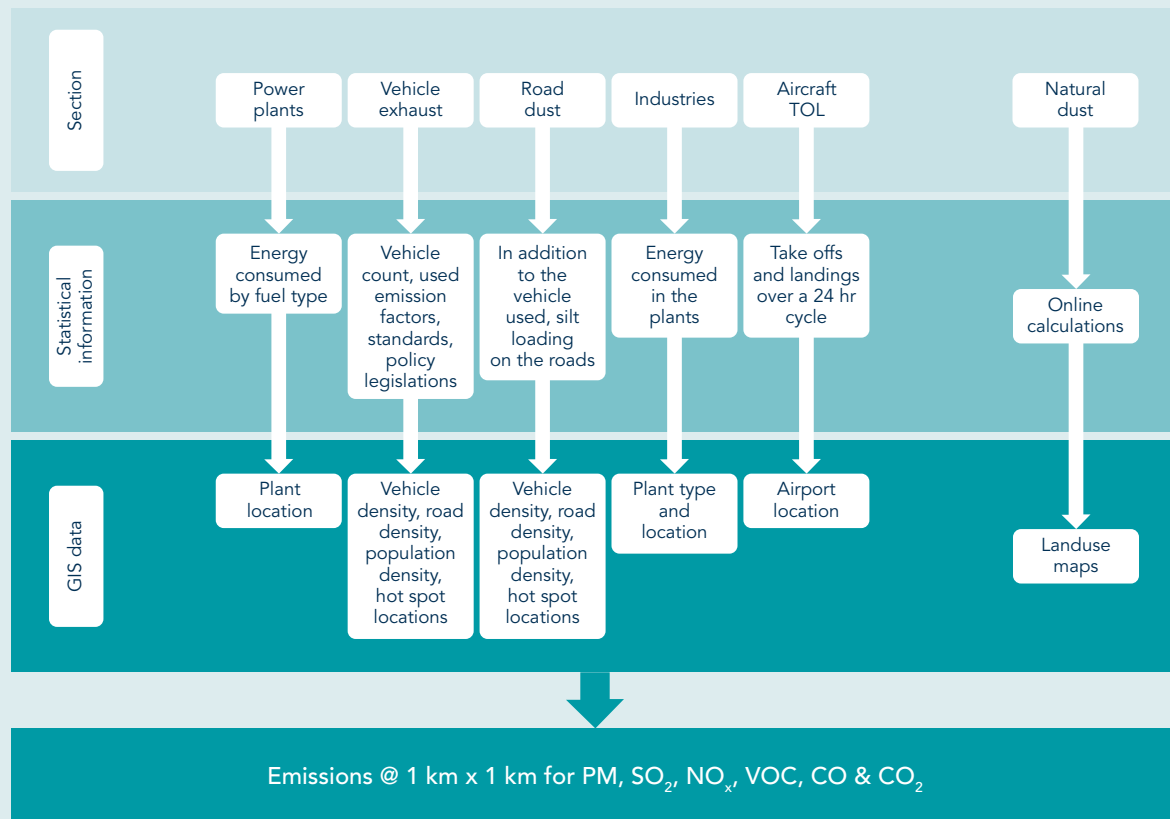
- Enhancing air quality monitoring network;
- Building local capacity to continue the modeling exercises;

### BOX 1 PLA Analytical Assessments

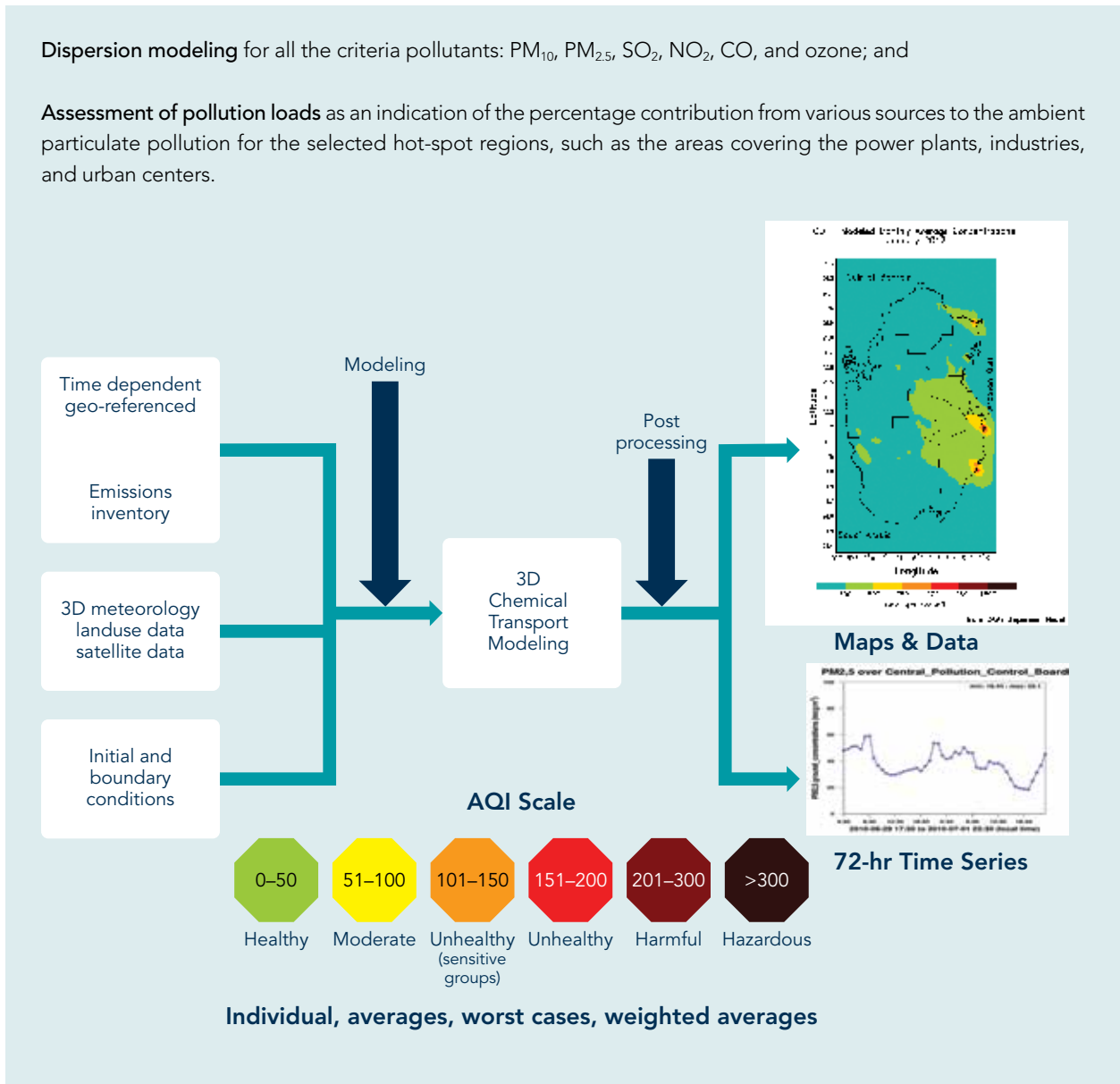
As part of the PLA, the following analytical assessments were carried out:

An analysis of the **air quality monitoring data** for the primary pollutants;

**Emissions inventory** from all known sources for PM, SO<sub>2</sub>, NO<sub>x</sub>, CO, and those necessary for the photochemical activity—non-methane volatile organic compounds (NMVOC);



(continued)



- Enhancing collaboration with other agencies to obtain raw data necessary for an effective emissions and pollution load assessment at the national and urban scales.

Strengthening of the national air quality management systems should allow the countries to approach the issue of air quality in a coordinated manner—through collaboration and regional programs particularly focusing on regional dust and pollution alerts.

More broadly and because of the cross sectoral nature of mitigation actions, the development of a comprehensive air

quality management system require to identify measures for improving air quality and assess their costs across sectors. Identifying the main contributors to poor air quality is not enough. Policy makers need also to undertake a careful cost effectiveness analysis to identify quick win actions in the short run, and the most efficient mitigation strategies to reduce air pollution taking into consideration the broader macro-economic and competitiveness goals.

The recently submitted Intended Nationally Determined Contribution (INDC) by all GCC countries provides a golden opportunity to further explore both at the sectoral and

cross sectoral level opportunities to strengthen our current engagement. At the global level, the majority of INDCs cover seven categories of gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>, NF<sub>3</sub>). Among GCC countries, some have a relatively large coverage, for example Oman chose to target CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, Kuwait chose to account for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O whereas other countries including Bahrain cover only CO<sub>2</sub> and N<sub>2</sub>O but note that other gases have only a marginal contribution to national emissions.<sup>1</sup> Among the GCC countries only the UAE indicated in its INDC submission that it has launched a process to develop a full national inventory of greenhouse gas emissions and is also undertaking a process to improve its air quality

measuring and reporting, in terms of pollution and the negative effects it may have on human health.

Many GCC countries report sectoral actions that may significantly contribute to tackle air pollution. Bahrain National Gas Company (Banagas) has completed a retrofit project of gas turbines which involves replacement of existing high NO<sub>x</sub> combustion liners resulting in an average reduction of 44% NO<sub>x</sub> emissions from the power generation station. Motor Vehicles Standards and technical regulations are adopted to reduce the emissions from gasoline and diesel engine vehicles in several countries, including the UAE, Qatar and Bahrain.

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<sup>1</sup> It should also be noted that small islands such as Bahrain makes relatively minor contributions to global greenhouse gas emissions and mitigation potential will largely depend on national circumstances, capacity and support. Bahrain's limitations in its size, population and economy give rise to constraints in financing, technical capacities and options for emission-reduction technology well documented in the INDC submission.

MIDDLE EAST AND NORTH AFRICA REGION  
GCC COUNTRY UNIT

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