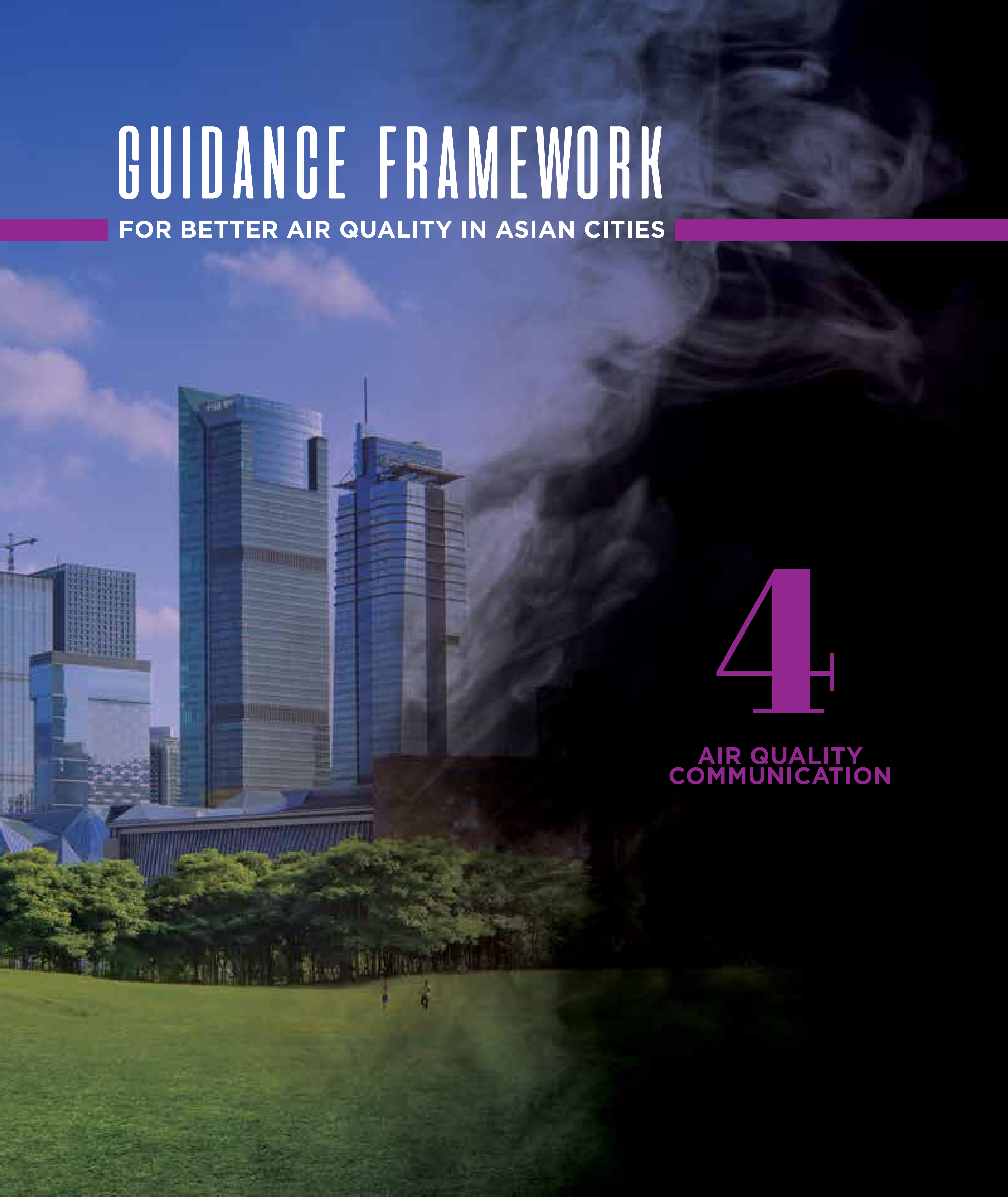
GUIDANCE FRAMEWORK

FOR BETTER AIR QUALITY IN ASIAN CITIES



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AIR QUALITY COMMUNICATION

Integrated Programme for Better Air Quality in Asia

UNEP

CLEAN AIR ASIA

GUIDANCE FRAMEWORK

FOR BETTER AIR QUALITY IN ASIAN CITIES

Guidance Area 4: Air Quality Communication

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ABOUT THE GUIDANCE FRAMEWORK FOR BETTER AIR QUALITY IN ASIAN CITIES

The Guidance Framework is a voluntary and non-binding guidance document developed as an outcome of the biennial Governmental Meetings on Urban Air Quality in Asia, co-organized by Clean Air Asia and United Nations Environment Programme Regional Office for Asia Pacific (UNEP ROAP). It is an outcome of an extensive development process, which began in 2006 when the Long Term Vision for Urban Air Quality in Asia (LTV) was envisioned by representatives of environment ministries in the region. The LTV describes the desired state of urban air quality in Asian cities by 2030; the Guidance Framework serves as a guide for cities and countries to achieve this vision. In 2016, the Guidance Framework was launched as a pioneering approach to resolve air pollution challenges at the local- and national-levels. Centered on identified priority areas of concern in air quality management in the region, the Guidance Framework provides cities and countries with development capacity indicators and recommended steps and actions to improve air quality.

The Guidance Framework serves as a cornerstone document of Clean Air Asia's Integrated Programme for Better Air Quality in Asia (IBAQ Programme), which supports countries and cities in implementing the Guidance Framework through a range of targeted interventions, including knowledge-sharing platforms to strengthen regional collaboration, capacity building activities such as trainings, study tours and city twinning, and technical assistance at both the national and subnational levels.

ABOUT CLEAN AIR ASIA
www.cleanairasia.org

Clean Air Asia is an international NGO established in 2001 as the premier air quality network for Asia by the Asian Development Bank, World Bank and USAID. Its mission is to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

Clean Air Asia became a UN-recognized partnership in 2007, its network spanning 261 organizations in 31 countries in Asia and worldwide, with nine country networks: China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, and Vietnam. It is headquartered in Manila and has offices in Beijing and Delhi. Clean Air Asia leads efforts to enable Asia's more than 1000 cities to reduce both air pollution and CO_2 emissions, and thereby contribute to more livable and healthy cities with blue skies and a low carbon footprint. Clean Air Asia helps to reduce emissions, through policies, plans, programs, and concrete measures that cover air quality, transport and industrial emissions and energy use.

The Better Air Quality (BAQ) Conference is a flagship event of Clean Air Asia covering the key sectors of transport, energy and industry, with a particular emphasis on government policies and measures. Policymakers, practitioners and industry leaders meet at BAQ to network, innovate, learn, and share experiences. The biennial event was first held in 2002 and attracts close to a thousand participants from Asia and the rest of the world.

ABOUT UNEP

www.unep.org

The United Nations Environment Programme (UNEP) is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment. UNEP work encompasses assessing global, regional and national environmental conditions and trends; developing international and national environmental instruments; and strengthening institutions for the wise management of the environment. UNEP's mission includes to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.

CONTENTS

PREFACE

Air pollution is now considered the world's largest environmental health risk. There have been a number of global efforts calling for air pollution actions in recent years. These global calls for action on air pollution strengthen regional and national initiatives and highlight the need to prioritize addressing this issue through a collaborative and integrated approach.

In 2006, the First Governmental Meeting on Urban Air Quality in Asia[1] recognized the need for guidance in implementing a Long Term Vision for Urban Air Quality in Asia, which describes the desired state of urban air quality management in Asian cities. During the Third Governmental Meeting, environment ministries from the region identified key challenges they are facing to improve urban air quality.

To set the way forward in achieving the vision for cleaner air, Clean Air Asia led the development of the Guidance Framework for Better Air Quality in Asian Cities (Guidance Framework) to address the needs and challenges in the region. It aims to provide a recognized guidance on improving urban air quality and is organized around priority areas of concern in the region, which were translated into key guidance areas with roadmaps on how to progress in a step by step manner.

This voluntary, non-binding document consists of seven individually published chapters covering each of the Guidance Areas. Policy and decision makers in Asia, as well as other relevant stakeholders, can use one or a combination of the Guidance Framework chapters to develop local roadmaps or action plans depending on their priority areas of concern.

The Guidance Framework consists of seven main books with these titles:

- Introduction
- Guidance Area 1 - Ambient air quality standards and monitoring
- Guidance Area 2 - Emissions inventories and modeling
- Guidance Area 3 - Health and other impacts
- Guidance Area 4 - Air quality communication
- Guidance Area 5 - Clean air action plans
- Guidance Area 6 - Governance

These guidance areas come with an Information Sourcebook, which is a compilation of resources to support the implementation of Guidance Framework roadmaps. There is also an accompanying training course on Guidance Framework implementation, which is available online in the Clean Air Asia website and Integrated Programme for Better Air Quality (IBAQ Programme) website: www.cleanairasia.org/ibaq

The Guidance Framework was developed together with a team of international and regional experts and practitioners and has undergone an extensive review process through the Governmental Meetings and the involvement of external reviewers. The draft document was also shared in a number of international events, including the Asia Pacific Clean Air Partnership (APCAP) Joint Forum organized by UNEP ROAP in November 2015. The Guidance Framework was welcomed by participants from 24 countries in Asia and the Pacific, involving environment ministries, intergovernmental organizations, non-governmental organizations, and experts.

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1 Governmental Meetings on Urban Air Quality in Asia are biennial meetings organized by the United Nations Environment Programme Regional Office of Asia and the Pacific (UNEP ROAP) and Clean Air Asia that convene environment ministries with the aim to harmonize approaches across the region in tackling air pollution and related fields.

ABBREVIATIONS

AB32	California State Law Assembly Bill 32
ADB	Asian Development Bank
API	Air Pollution Index
AQ	Air Quality
AQHI	Air Quality and Health Index
AQM	Air Quality Management
AQS	Air Quality Standards
BRT	Bus Rapid Transit
CSE	Centre for Science and Environment
CO	Carbon monoxide
EC	European Commission
EEA	European Environment Agency
EPD (Hong Kong)	Environmental Protection Department
GDP	Gross Domestic Product
GHG	Greenhouse Gas
MOEJ	Ministry of the Environment of Japan
NO_2	Nitrogen dioxide
O_x	Photochemical oxidants
O_3	Ozone
PBL	Planbureau voor de Leefomgeving
PCD (Thailand)	Pollution Control Department
PM	Particulate Matter
PM_{10}	Particulate Matter (≤ 10 micrometers in diameter)
$PM_{2.5}$	Particulate Matter (≤ 2.5 micrometers in diameter)
SPM	Suspended Particulate Matter
SO_2	Sulfur dioxide
UNECE	United Nations Economic Commission for Europe
USEPA	United States Environmental Protection Agency
WHO	World Health Organization


世界人民大团结

Communication is an essential part of **air quality management** because the adoption of **air pollution control measures** will only be effective if its **relevance and impact** are conveyed to policymakers and to interested parties likely to be **affected by the intervention**.

CHAPTER 5

GUIDANCE AREA 4: AIR QUALITY COMMUNICATION

5.1 Introduction

Air quality (AQ) communication involves the active use of data to inform the general public and key stakeholders about air pollution issues. It aims to raise awareness, change attitudes and foster behavior change. Communication is an essential part of air quality management (AQM) because the adoption of air pollution control measures will only be effective if its relevance and impact are conveyed to policymakers and to interested parties likely to be affected by the intervention. In communicating air pollution prevention, careful consideration should be given to the target audiences, the message that is being sent, and the communication channel used to deliver it.

5.1.1 Objective

To develop an effective communication strategy to inform, educate and strengthen stakeholders' participation in all aspects of AQM, in order to prevent and reduce air pollution impacts.

5.1.2 Why communicate air quality issues?

The communication of AQ issues, particularly to the general public, is normally required as part of national legislation that has provisions for authorities to inform and warn the public when air quality standards (AQS) are exceeded. Moreover, numerous policies adopted to reduce urban air pollution can also assist in mitigating climate change and vice versa [See *Guidance Area 6 on Governance*] (Nemet et al., 2010). Communication of these potential 'co-benefits' can encourage stakeholders to support the adoption and implementation of emissions reduction measures.

A rise in environmental awareness over the past decades means the public is now more concerned about the quality of the air they breathe. A 2011 Clean Air Asia survey on public perceptions of air pollution in Asia found that the majority of the 628 individuals surveyed felt that AQ in their city had deteriorated or had remained the same as the previous year. They perceived motor vehicles as the main source of pollution and felt that air pollution was affecting their health (Clean Air Asia, 2011a). These results were further confirmed in a 2013 Centre for Science and Environment (CSE) air pollution survey of New Delhi residents, which found that approximately 64 percent of respondents felt air pollution was worsening. Also, 74 percent of respondents said that air pollution was responsible for respiratory symptoms, the frequency of which increased during winter (CSE, 2013).

However, many individuals are not only victims of air pollution but are also contributors to the problem. Understanding public perception of, and attitudes to AQ, is important in ensuring successful citizen involvement in AQM (Saksena, 2007). A number of factors shape public attitudes and behavior. These include: knowledge (e.g., how individuals interpret information based on existing beliefs); psychological factors (e.g., values, attitudes and emotions that affect behavior and give a sense of responsibility); habits (e.g., mostly habitual and routine behavior that contributes to polluting emissions); structural conditions (e.g., infrastructure — or lack of it — that can lead to "lock-in" situations, providing an obstacle to behavioral change); and socio-demographic patterns (e.g., the influence of these factors vary with individual circumstances) (Haq et al., 2013). Communication is therefore important to raise awareness, change public attitudes, and promote environmentally friendly behaviors, such as the use of public transport and non-motorized transport.

A range of organizations and groups are involved in the communication of AQ information. These include: environmental agencies that are monitoring, collating, and reporting on the state of AQ; public health agencies that are providing advice to protect health; non-governmental organizations that are raising awareness and creating political pressure; and the media, which provide the communication channels to reach different stakeholder groups.

5.1.3 Overview of guidelines on the provision of public information on air quality

The 1998 United Nations Economic Commission for Europe (UNECE) Aarhus Convention establishes the public right to have access to environment information and participate in decision-making to ensure environmental justice. Parties to the Convention are required to make the necessary provisions so that public authorities – at national, regional or local level – implement these rights in practice. Under the Convention, everyone has the right to receive environmental information that is held by public authorities, to participate in environmental decision-making, and to review procedures to challenge public decisions that have been made without respecting public rights or environmental law in general.

A number of international guidelines on the reporting and dissemination of AQ information is currently available (Box 5.1). European Directive 2008/50/EC on ambient AQ requires that the public and appropriate organizations – i.e., environmental, consumer, healthcare bodies, industry federations – should be provided with adequate ambient AQ information. This should be freely available and accessible through any media, including the internet or telecommunications. Annual reports for all pollutants stating when limit values, target values, and long-term objectives have been exceeded should also be publicly available. Section 127 of the United States Clean Air Act (1990) outlines the need to inform the public on the status of AQ.

An Asian Development Bank (ADB) and Clean Air Asia (2014) report on good practice for AQ monitoring distinguishes between information for the public and information for policymakers. Public AQ information should be translated in a form that is accessible, concise, and easy to understand; while information for policy makers should be framed in such a way that it is incorporated into a relevant issue or scenario – e.g., comparative advantages, sociopolitical trends, economic trends, and so on. In contrast, researchers/scientists require more detailed and technical AQ information – technical reports, scientific publications in peer-reviewed journals, and online databases can be used as references for their studies. Information is best shared among this group of stakeholders through conferences, seminars, and workshops.

A rise in **environmental awareness** over the past decades means the public is now **more concerned** about the **quality of the air** they breathe.

Box 5.1
Guidance on the Provision of Public Information on Air Quality

European Directive 2008/50/EC
Annex XVI

Member States shall ensure that up-to-date information on ambient concentrations of the pollutants covered by EC Directive 2008/50/EC is routinely made available to the public.

Ambient concentrations provided shall be presented as average values according to the appropriate averaging period. The information shall at least indicate any levels exceeding air quality objectives, including limit values, target values, alert thresholds, information thresholds, or long term objectives of the regulated pollutant. It shall also provide a short assessment in relation to the air quality objectives and appropriate information regarding effects on health, or, where appropriate, vegetation.

Information on ambient concentrations of sulfur dioxide, nitrogen dioxide, particulate matter (PM) (at least PM_{10}), ozone, and carbon monoxide shall be updated on at least a daily basis, and, wherever practicable, information shall be updated on an hourly basis. Information on ambient concentrations of lead and benzene, presented as an average value for the last 12 months, shall be updated on a three-month basis, or on a monthly basis, wherever practicable.

Member States shall ensure that timely information about actual or predicted exceedances of alert thresholds and any information threshold is provided to the public. Details supplied shall include at least the following information:

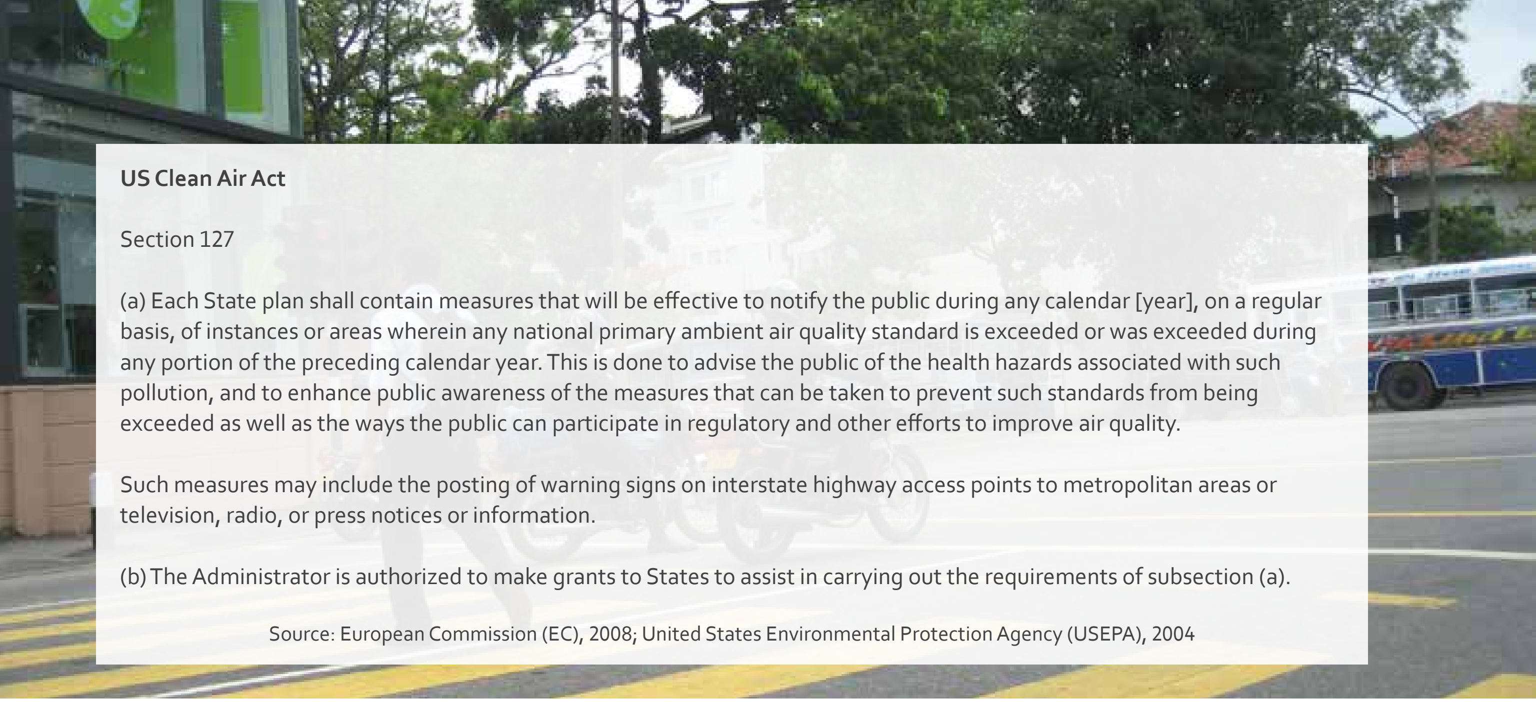
(a) information on observed exceedance(s):
- — location or area of the exceedance,
- — type of threshold exceeded (information or alert),
- — start time and duration of the exceedance,
- — highest one hour concentration and in addition highest eight hour mean concentration in the case of ozone;

(b) forecast for the following afternoon/day(s):
- — geographical area of expected exceedances of information and/or alert threshold,
- — expected changes in pollution (improvement, stabilization or deterioration), together with the reasons for those changes;

(c) information on the type of population concerned, possible health effects and recommended behavior:
- — information on population groups at risk,
- — description of likely symptoms,
- — recommended precautions to be taken by the population concerned,
- — where to find further information;

(d) information on preventive action to reduce pollution and/or exposure to it: indication of main source sectors; recommendations for action to reduce emissions; and

(e) in the case of predicted exceedances, Member State shall take steps to ensure that such details are supplied to the extent practicable.



US Clean Air Act

Section 127

(a) Each State plan shall contain measures that will be effective to notify the public during any calendar [year], on a regular basis, of instances or areas wherein any national primary ambient air quality standard is exceeded or was exceeded during any portion of the preceding calendar year. This is done to advise the public of the health hazards associated with such pollution, and to enhance public awareness of the measures that can be taken to prevent such standards from being exceeded as well as the ways the public can participate in regulatory and other efforts to improve air quality.

Such measures may include the posting of warning signs on interstate highway access points to metropolitan areas or television, radio, or press notices or information.

(b) The Administrator is authorized to make grants to States to assist in carrying out the requirements of subsection (a).

Source: European Commission (EC), 2008; United States Environmental Protection Agency (USEPA), 2004

5.1.4 Platforms for communicating air quality

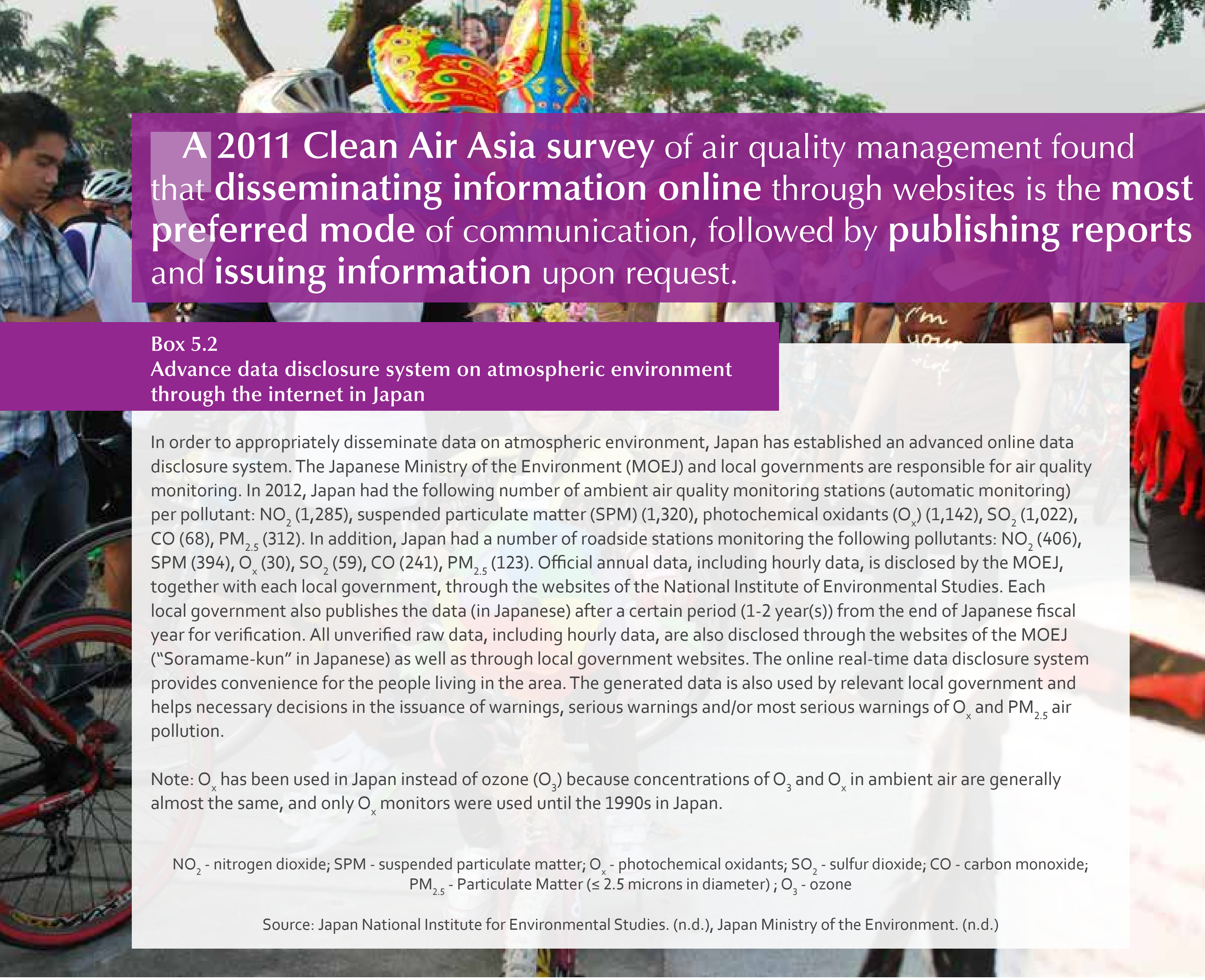
A wide range of channels, such as those listed below, is currently used to communicate the status of AQ in Asian cities to the general public and key stakeholders:

- Published (printed) reports – reports, brochures, papers
- Print media – newspapers
- Broadcast media – television and radio
- Website – online databases
- Email or mobile alerts
- Public display screens or booths/information boards
- Internal communications/requests
- Upon-request information
- Others: social networking sites, microblogs

Commonly used tools to communicate air quality information to policymakers include:

- Policy briefs
- Written reports
- Summary tables
- Visual presentations
- Interpretation of information
- Pie chart and map
- Satellite imagery

A Clean Air Asia survey of AQM (ADB & Clean Air Asia, 2014) found that disseminating information online through websites is the most preferred mode of communication, followed by publishing reports and issuing information upon request. The least used mode of information dissemination is broadcasting on television and publishing in the print media. Air quality monitoring data in Japan is disseminated through an advanced online data disclosure system to gain support of the general public in promoting upgrade and improvement of AQ monitoring systems (Box 5.2).



> **A 2011 Clean Air Asia survey** of air quality management found that **disseminating information online** through websites is the **most preferred mode** of communication, followed by **publishing reports** and **issuing information** upon request.

Box 5.2
Advance data disclosure system on atmospheric environment through the internet in Japan

In order to appropriately disseminate data on atmospheric environment, Japan has established an advanced online data disclosure system. The Japanese Ministry of the Environment (MOEJ) and local governments are responsible for air quality monitoring. In 2012, Japan had the following number of ambient air quality monitoring stations (automatic monitoring) per pollutant: NO_2 (1,285), suspended particulate matter (SPM) (1,320), photochemical oxidants (O_x) (1,142), SO_2 (1,022), CO (68), $PM_{2.5}$ (312). In addition, Japan had a number of roadside stations monitoring the following pollutants: NO_2 (406), SPM (394), O_x (30), SO_2 (59), CO (241), $PM_{2.5}$ (123). Official annual data, including hourly data, is disclosed by the MOEJ, together with each local government, through the websites of the National Institute of Environmental Studies. Each local government also publishes the data (in Japanese) after a certain period (1-2 year(s)) from the end of Japanese fiscal year for verification. All unverified raw data, including hourly data, are also disclosed through the websites of the MOEJ ("Soramame-kun" in Japanese) as well as through local government websites. The online real-time data disclosure system provides convenience for the people living in the area. The generated data is also used by relevant local government and helps necessary decisions in the issuance of warnings, serious warnings and/or most serious warnings of O_x and $PM_{2.5}$ air pollution.

Note: O_x has been used in Japan instead of ozone (O_3) because concentrations of O_3 and O_x in ambient air are generally almost the same, and only O_x monitors were used until the 1990s in Japan.

NO_2 - nitrogen dioxide; SPM - suspended particulate matter; O_x - photochemical oxidants; SO_2 - sulfur dioxide; CO - carbon monoxide; $PM_{2.5}$ - Particulate Matter (≤ 2.5 microns in diameter) ; O_3 - ozone

Source: Japan National Institute for Environmental Studies. (n.d.), Japan Ministry of the Environment. (n.d.)

Factors such as cost, frequency of reporting and information format influence the type of communication channel used to disseminate AQ information. Publishing information online is considered to be significantly cheaper than the cost of using television and print media. In addition, advances in communication technology make sharing and accessing of data easier through the use of downloadable mobile applications. For example, Thailand's Pollution Control Department (PCD) has established the mobile application Air4Thai, which makes AQ information available to users in Bangkok and other areas in Thailand.

In terms of method or format of AQ information to be disseminated, several ways of presenting AQ information in Asian cities have been identified (ADB & Clean Air Asia, 2014):

- raw number – raw data is shared in numerical form
- raw graph – raw data is shared in graphical form
- conc – AQ data is expressed as concentration
- stats – AQ data has undergone statistical analyses (e.g., expressed as percentiles)
- spatial – AQ data is represented spatially
- text – data has an accompanying text that describes the AQ

5.1.5 The use of indexes in air quality communication

Air Quality Index (AQI) is often used as a tool to communicate the state of AQ to the public. Different countries have their own AQIs corresponding to different national AQS such as the Air Pollution Index (Malaysia) and the Pollutant Standard Index (Singapore).

The AQI translates raw data (e.g., pollutant concentrations) to a number on a scale that is further divided into bands that correspond to a defined pollution concentration. Depending on the AQI value, these bands could be defined as "good", "moderate", "unhealthy for sensitive groups", "unhealthy", "very unhealthy", and "hazardous", which have different meanings for different vulnerable groups of the population. The index is also color-coded to make the information more comprehensible and visually appealing. Table 5.1 presents an example of an AQI produced by the USEPA.

However, AQIs can vary from one country to another in terms of the type of pollutants monitored, the range of values, and the banding. It is important that AQIs are free from ambiguity and that uniform AQI categories are used throughout the country by different agencies (Box 5.3).

Public awareness of AQIs or alerts also varies between countries. There is limited evidence to suggest that individuals change behavior to reduce exposure, either in response to air quality data or perceptions of exposure. A US study found that while a third of 1,962 participants were aware of air quality alerts, only 10-15 percent of individuals reported changing behavior in response to predicted poor air quality. Instead, personal perceptions of poor air quality were cited as the main driver of behavior than official advice (Laumbach et al., 2015).

The AQI is not the only form of expressing AQ information. In most cases, indexes are enhanced with other data visualization tools such as the geographical information system to show the spatial variation of AQ and distribution of air pollutants. Some cities also take advantage of novel technologies and innovative approaches to convey AQ information (Box 5.4).

An ADB & Clean Air Asia (2014) survey of AQ monitoring in Asian cities found that only 55 percent of the cities mentioned use AQIs. Table 5.2 shows eight countries (Brunei Darussalam, India, Malaysia, People's Republic of China, Republic of Korea, Singapore, Thailand, and Vietnam) fully implement AQIs. A number of countries had national guidelines for indexes; however, these were only implemented in a few cities or were not implemented at all.

Table 5.1 USEPA Air Quality Index including different bands and corresponding definitions

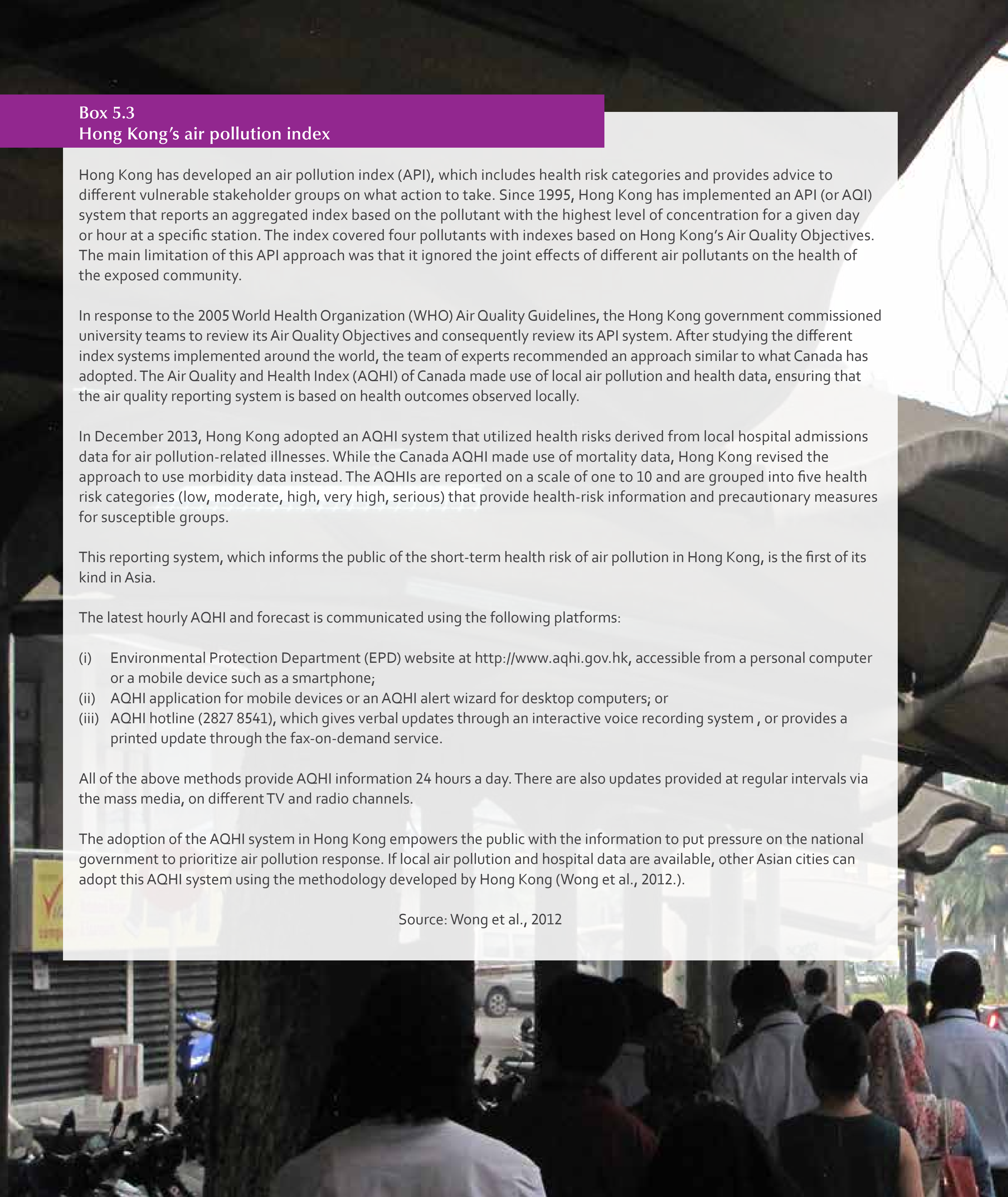
Numerical Value	Levels of Health Concern	Meaning
0 to 50	Good	Air quality is considered satisfactory and air pollution poses little or no risk
51 to 100	Moderate	Air quality is acceptable; however, for some pollutants, there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution
101 to 150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected
151 to 200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious effects
201 to 300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected
301 to 500	Hazardous	Health alert: everyone may experience more serious health effects

Source: USEPA, 2013

Table 5.2 Overview of air quality (and similar) indexes in Asia

Countries	Status	Official Name	Reporting Frequency	Pollutants Included
Afghanistan	—	—	—	—
Bangladesh	Proposed	Air Quality Index	Daily	SO_2, NO_2, CO, O_3, $PM_{2.5}$, PM_{10}
Bhutan	—	—	—	—
Brunei Darussalam	Implemented	Pollution Standard Index	Daily	PM_{10}
Cambodia	—	—	—	—
PR China	Implemented	Air Quality Index	Hourly	SO_2, NO_2, PM_{10}, CO, O_3, $PM_{2.5}$
India	Implemented	National Air Quality Index	Hourly	SO_2, NO_2, CO, O_3, NH_3, $PM_{2.5}$, PM_{10}, Pb
Indonesia	Implemented but irregular	Indeks Standar Pencemar Udara/ Pollution Standard Index	Daily	PM_{10}, SO_2, CO, O_3, NO_2
Japan	—	—	—	—
Lao PDR	—	—	—	—
Malaysia	Implemented	Air Pollutant Index (API)	Hourly	CO, O_3, SO_2, NO_2, PM_{10}
Myanmar	—	—	—	—
Nepal	—	—	—	—
Pakistan	Implemented but irregular	Air Quality Index	Daily (Irregular)	Includes PM_{10}, $PM_{2.5}$
Philippines	Implemented in selected cities	Air Quality Index	Daily	TSP, SO_2, CO, O_3, NO_2, PM_{10}, $PM_{2.5}$
Republic of Korea	Implemented	Community Air Quality Index	Hourly	SO_2, NO_2, CO, O_3, PM_{10}
Singapore	Implemented	Pollution Standard Index	Daily, 3-hr, hourly (for $PM_{2.5}$)	$PM_{2.5}$, PM_{10}, SO_2, CO, O_3, NO_2
Sri Lanka	Established but not implemented	Sri Lanka Air Quality Index	Daily, weekly	O_3, $PM_{2.5}$, PM_{10}, CO, SO_2, NO_2
Thailand	Implemented	Air Quality Index	Hourly, daily	PM_{10}, O_3, SO_2, NO_2, CO
Vietnam	Implemented	Air Quality Index	Hourly	Not indicated

Source: Updated from ADB & Clean Air Asia (2014)



Box 5.3
Hong Kong's air pollution index

Hong Kong has developed an air pollution index (API), which includes health risk categories and provides advice to different vulnerable stakeholder groups on what action to take. Since 1995, Hong Kong has implemented an API (or AQI) system that reports an aggregated index based on the pollutant with the highest level of concentration for a given day or hour at a specific station. The index covered four pollutants with indexes based on Hong Kong's Air Quality Objectives. The main limitation of this API approach was that it ignored the joint effects of different air pollutants on the health of the exposed community.

In response to the 2005 World Health Organization (WHO) Air Quality Guidelines, the Hong Kong government commissioned university teams to review its Air Quality Objectives and consequently review its API system. After studying the different index systems implemented around the world, the team of experts recommended an approach similar to what Canada has adopted. The Air Quality and Health Index (AQHI) of Canada made use of local air pollution and health data, ensuring that the air quality reporting system is based on health outcomes observed locally.

In December 2013, Hong Kong adopted an AQHI system that utilized health risks derived from local hospital admissions data for air pollution-related illnesses. While the Canada AQHI made use of mortality data, Hong Kong revised the approach to use morbidity data instead. The AQHIs are reported on a scale of one to 10 and are grouped into five health risk categories (low, moderate, high, very high, serious) that provide health-risk information and precautionary measures for susceptible groups.

This reporting system, which informs the public of the short-term health risk of air pollution in Hong Kong, is the first of its kind in Asia.

The latest hourly AQHI and forecast is communicated using the following platforms:

(i) Environmental Protection Department (EPD) website at http://www.aqhi.gov.hk, accessible from a personal computer or a mobile device such as a smartphone;
(ii) AQHI application for mobile devices or an AQHI alert wizard for desktop computers; or
(iii) AQHI hotline (2827 8541), which gives verbal updates through an interactive voice recording system , or provides a printed update through the fax-on-demand service.

All of the above methods provide AQHI information 24 hours a day. There are also updates provided at regular intervals via the mass media, on different TV and radio channels.

The adoption of the AQHI system in Hong Kong empowers the public with the information to put pressure on the national government to prioritize air pollution response. If local air pollution and hospital data are available, other Asian cities can adopt this AQHI system using the methodology developed by Hong Kong (Wong et al., 2012.).

Source: Wong et al., 2012

Box 5.4
Innovative approaches to air quality communication

Living Light, Seoul, South Korea

Image source: http://www.livinglightseoul.net/

Living Light is a building facade of the future that displays air quality and public interest in the environment. It is a permanent outdoor pavilion in Peace Park in Seoul, Korea. It has a dynamic skin that glows and blinks in response to both data about air quality and public interest in the environment. It is unique for its capability to dynamically represent environmental air quality via a public media architecture structure. Parts of the panel roof glow when the air quality is better than last year's or when onlookers send a text message querying the data for a specific postcode.

The outer perimeter of the pavilion represents a giant map of Seoul with the 27 neighborhood boundaries redrawn based on existing air quality sensors of the Korean Ministry of Environment. Each shape in this new map encloses the air space closest to one of the sensors. The map then illuminates based on the comparison of historical and real-time sensor data, and text messaging requests from passers-by, becoming an interactive, environmental building façade (Infosthetics, 2009).

Ballon de Paris, Paris France

Image Source: https://plus.google.com/+A%C3%A9roparisBallondeParis/posts

Since 2008, the balloon, called Ballon de Paris, has been partnering with AIRPARIF (a licensed air-quality-measurement company in France). Not only does the balloon have the capacity to take air quality measurements, but changes color depending on the quality of ambient air in Paris. Every two hours the balloon shows two air quality indices: ambient air quality provided by six urban stations and air quality measured at five traffic stations in Paris.

Very Good | Good | Fair | Poor | Very Poor

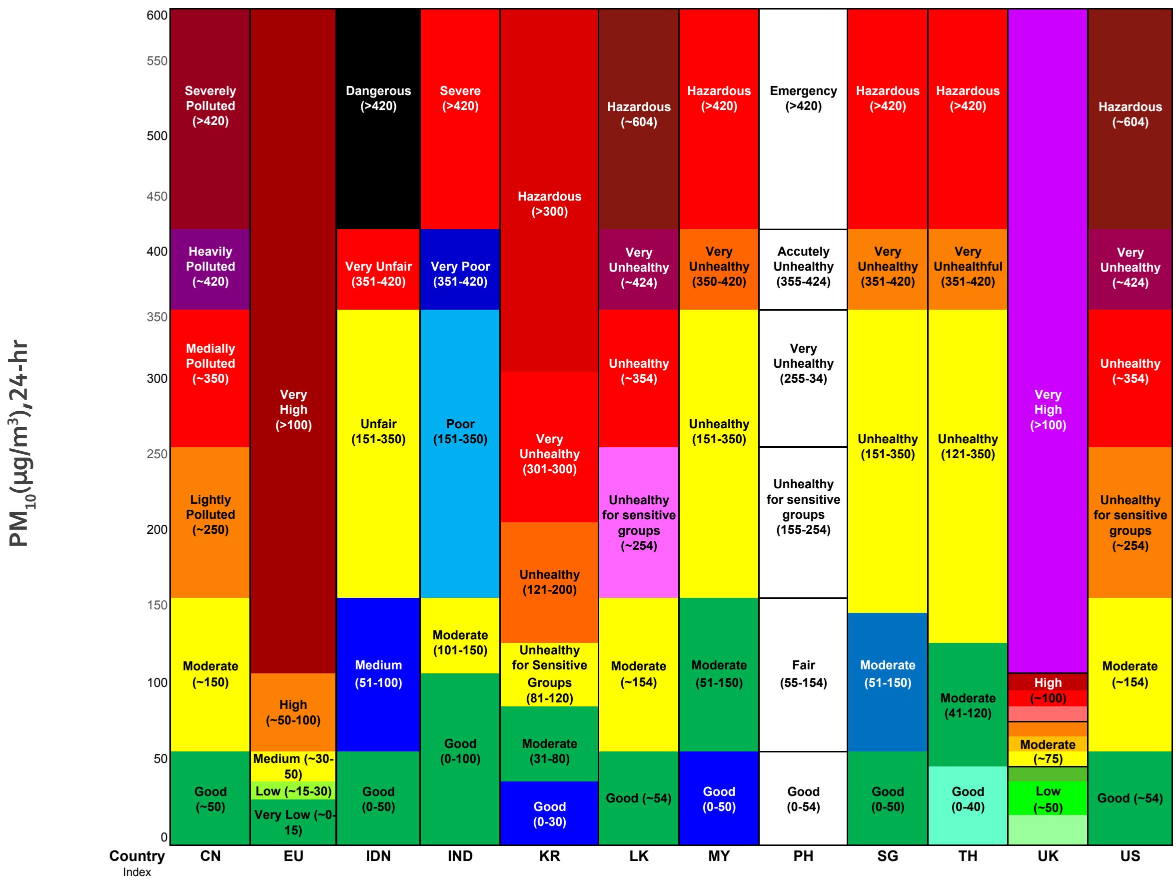
The indices illustrate in a simple and easily understandable manner the amount of the three most problematic pollutants in major European cities: NO_2, O_3 and PM. The balloon turns green for good air quality in Paris, orange for fair and red for poor. It can be seen for over 19 kilometres (12 miles) (Ballon de Paris, 2015).

Source: Infosthetics, 2009; Ballon de Paris, 2015

In Asia, AQIs may significantly vary from one country to another (Figure 5.1). Some of the key variations in different components are summarized below:

- Pollutants Covered: Most countries have indexes on PM_{10}, SO_2, NO_2, and CO. Very few consider $PM_{2.5}$.
- Bands: Bands of the pollutant concentrations vary per country, usually depending on their national ambient AQS.
- Frequency of Reporting: Most report the index daily, with China and Republic of Korea reporting hourly.
- Reporting Area: Mostly by stations but are also offered by region/district in some developed cities.
- Reporting Channels: Mostly reported through websites but there are other countries that also include reporting through smartphone apps, social networks, newspapers, radio and television.
- Text Descriptions: Some countries base description on pollution levels (low, slightly polluted, high); while others base it on health impacts (low, unhealthy for sensitive groups, unhealthy, and hazardous).

These variations may lead to public confusion in interpreting AQIs from different cities or countries. Hence, it may be useful to explore the harmonization of AQIs in Asia despite the challenges posed by various national AQ guidelines/standards used in different countries.



CN = China; EU = European Union; IDN = Indonesia; IND = India; KR = Republic of Korea; LK = Sri Lanka; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; UK = United Kingdom; US = United States

Figure 5.1 Comparison of PM_{10} AQI in selected countries

Source: Clean Air Asia, 2015

In 2010, ADB & Clean Air Asia developed a Clean Air Scorecard to provide a comparative index that could be used to identify potential improvement areas for Asian cities. The Clean Air Scorecard is an Excel-based tool incorporating three indexes: (i) Air Pollution and Health, (ii) Clean Air Management Capacity, and (iii) Clean Air Policies and Actions. This work aims to address the need for a comparative index that may be used to assess AQ levels. The Air Pollution and Health Index (APHI) assesses air pollution levels of cities against WHO guideline values and interim targets (Table 5.3). A "good air" day in this index therefore relates to WHO guidelines rather than the city's ambient air quality standards (AAQS), which are generally less stringent. This index includes six pollutants (PM_{10}, $PM_{2.5}$, SO_2, NO_2, O_3, and CO). A city is required to have, at a minimum, monitoring data for PM with a diameter of 10 microns or less (PM_{10}). The WHO guidelines and interim targets were considered as the basis for the excellent category. Succeeding categories were based on interim targets 1 and 2 as well as annual average levels of Asian cities.[2]

The index is separately calculated for each pollutant and not as a composite index. For a city with data for different pollutants, the pollutant with the lowest score is considered the main pollutant of concern. As such, the score considered in the computation of the city's overall clean air score is based on the pollutant with the lowest score under the APHI. When comparing cities, however, it is required that the cities' APHI score is based on the same pollutant or set of pollutants. Table 5.3 presents the score banding and description for each category.

2 For example, excellent is based on the WHO guideline of 20 $\mu g/m^3$ and interim target 3 of 30$\mu g/m^3$. Good and moderate categories are based on the interim target 2 of 50 $\mu g/m^3$ and the interim target 1 of 70 $\mu g/m^3$, respectively. Poor and very poor categories are based on annual average PM_{10} of 101.23 $\mu g/m^3$ in 180 cities in Asia and the standard deviation of 50 $\mu g/m^3$.

Table 5.3 Score bands and category descriptions for the Air Pollution and Health Index

Air Pollution and Health Index		
Category	**Score Band**	**Description**
Excellent	81–100	Low levels of pollution within WHO-prescribed guidelines. Public health implications for pollutants monitored are limited and hardly noticeable.
Good	61–80	Relatively low levels of air pollution but considerable impacts to sensitive groups.
Moderate	41–60	Elevated levels of air pollution with aggravated symptoms for sensitive groups and contributing to onset of risks for exposed healthy individuals.
Poor	21–40	High levels of pollution with significant health effects to vulnerable populations and contributing to increased risks for exposed healthy individuals.
Very Poor	11–20	Extremely high levels of pollution affecting a large share of population.
Critical	1–10	Critical levels of air pollution resulting in adverse health effects to public in general.

Source: Clean Air Asia, 2011b

Since its development, the Clean Air Scorecard has been applied in 24 Asian cities in nine countries (Bac Ninh, Bangkok, Cagayan de Oro, Can Tho, Changchung, Chiang Mai, Colombo, Dalian, Foshan, Guangzhou, Hangzhou, Hanoi, Harbin, Iloilo, Jakarta, Jiangyin, Jinan, Kathmandu, Korat, Metro Manila, Quetta, Tongxiang, Visakhapatnam, Zhaoqing). The Clean Air Scorecard bandings in the APHI may be adapted to follow the same format of existing AQIs where poor AQ has low AQI values and good AQ has high AQI values.

Table 5.4 shows the characteristics of AQ status reports in selected Asian countries. Most of the reports focus on data analysis. While useful, it can overlook other aspects of AQM such as the health and socioeconomic impacts of air pollution as possible measures to mitigate the impacts. Priority action areas to improve AQ are also absent. Such deficiencies are missed opportunities in ensuring that policymakers understand the situation and that they are provided with the evidence base for formulating sound policies.

Generally, national (and sometimes regional) AQ status reports have a prescribed format, content and reporting frequency. However, AQM is primarily a local issue and city residents are interested to know the quality of the air they are breathing and the progress of the implementation of AQM measures and plans. Unfortunately, national reports have a broad scope and cannot provide detailed information per locality. Current national AQ status reports usually focus on compliance with standards and target values, and are unfortunately presented in a format that is not accessible to the public.

Table 5.4 Overview of air quality status reports in selected Asian countries

Country/City	Title	Lead Organization	Frequency	Most recent version during drafting of document (2014)
India	National Ambient Air Quality Status Report	Central Pollution Control Board	Annual	2012
Malaysia	As part of: Malaysia Environmental Quality Report	Department of Environment	Annual	2013
Philippines	National Air Quality Status Report	Environmental Management Bureau	Every two years	2010-2011
PR China	As part of: State of the Environment in China	Ministry of Environmental Protection	Annual	2012
	State of 74 Cities Air Quality	Ministry of Environmental Protection	Monthly	2014
Republic of Korea	Monthly and Annual Report of Air Quality in Korea (in Korean)	Ministry of Environment	Monthly/ Annual	Monthly (February 2015); Annual (2014)
Thailand	Thailand's Air & Noise Status and Management (in Thai)	Pollution Control Department	Annual	2012
Vietnam	As part of: National Environmental Report	VEA	Annual	2012

Contents	Status/ Remarks	Link
• Air quality monitoring system information • Air quality assessment (for one year): general and pollutant- specific (SO_2, NO_2, SPM, PM_{10}, and others) • Air quality trends • Initiatives for air pollution control	2012 version published in January 2014	http://cpcb.nic.in/divisionsofheadoffice/pams/NAAQStatus_Trend_Report_2012.pdf
• Air quality: monitoring, current status, and trends • River, ground and marine water quality • Pollution sources inventory	Regularly prepared and published	https://enviro.doe.gov.my/view.php?id=15791
• Sources of air pollution • Status of ambient air quality • Air quality management (by source and by organization) • Best practices and lessons learned • Challenges and recommendations	Report for 2012 under preparation	Most recent: http://www.emb.gov.ph/portal/Portals/23/PDF%20Files/DenrAirQualityStatReport10-11.pdf For past reports: http://emb.gov.ph/eeid/publications.htm
• Reduction of total discharge of major pollutants • Atmospheric environment: status of air quality (by pollutant), acid rain frequency and distribution, emissions estimates and measures, actions • State of water, marine, acoustic, solid waste, radiation, nature and ecology, land and rural environment, forest, grassland, climate and natural disasters • Environmental management	Regularly prepared and published (in Chinese and English)	http://english.mep.gov.cn/standards_reports/soe/
• Air quality: monthly average concentration of pollutants; pollutants and cities of concern	Regularly prepared and published online	http://www.cnemc.cn/publish/totalWebSite/news/news_40273.html
• Air quality standard • Sources of air pollution • Air quality monitoring system information • Status of ambient air quality • Air quality management • Air Quality forecast & alert system • Status on yellow sand	Prepared and published from 1998 to 2014 in Korean	http://www.airkorea.or.kr/last_amb_hour_data http://www.airkorea.or.kr/eng/real/realTime
• Air quality status and volume of emissions • Measures on prevention and control of air and noise pollution with focus chapters on key sources (industry/vehicles) • Public awareness campaigns	Regularly prepared and published but only available in Thai	http://www.pcd.go.th/download/en_air.cfm
• Economic development activities, changes in climate and other environmental pressures • State of environment – quality of soil, water and air • Special focus on solid waste and biodiversity • Impacts of environmental pollution • State of environmental management • Proposed measures	Regularly prepared and published but only available in Vietnamese (except for 2007). Each year has a different theme. 2012 focused on surface but 2013 will focus on air environment.	http://vea.gov.vn/vn/hientrangmoitruong/baocaomtquocgia/Pages/default.aspx

Source: Updated from Clean Air Asia, 2012

5.1.6 Communicating co-benefits of air quality and climate change

Many strategies to reduce greenhouse gases (GHGs) also have the added co-benefit of decreasing air pollutants (e.g. PM, NO_x, and SO_2). Measures to reduce emissions of GHGs to 50 percent of 2005 levels by 2050 can reduce the number of premature deaths from the chronic exposure to air pollution by 20 to 40 percent. The most significant of these measures is switching from fossil fuels to renewable energy (Planbureau voor de Leefomgeving [PBL], 2009).

However, there is currently no single "meta-metric" to deliver all information needed for a meaningful integration of air and climate policies (European Environmental Agency [EEA], 2013). Metrics used to communicate the Global Warming Potential/Global Temperature Change Potential or the relative contribution of GHGs to climate change – parts per billion (ppb) – of CO_2, for example, are different from the metrics for air quality – ambient concentrations micrograms per cubic meter ($\mu g/m^3$). In addition, health and ecosystem metrics are impact-focused (mortality, morbidity, crop losses, among others). There is a need for a suite of metrics with a focus on integrated policies.

The inclusion of AQ benefits in the design of climate strategies can be used to motivate stakeholders to take action as AQ benefits are local, nearer term and have health benefits (Nemet et al., 2010). This includes highlighting the economic costs of action, especially to decision-makers.

The AQ co-benefits of climate change mitigation have been estimated within the range of US$2- $196 per ton of CO_2 (t/CO_2), with an average of US$49 t/$CO_2$. The highest benefits occur in developing countries (Nemet et al., 2010). For example, if China pursued a stringent air policy to reduce the number of premature deaths from chronic exposure to outdoor air pollution by 70 percent by 2050, this policy will lower gross domestic product (GDP) by 7 percent (compared with a baseline trend without policy). However, the air quality benefits would be equivalent to 7.5 percent of GDP while greenhouse gas emissions would be 40 percent lower (PBL, 2009). Box 5.5 discusses the co-benefits achieved from the implementation of legislation to reduce GHGs in the USA.

Box 5.5
Achieving co-benefits in California

On September 27, 2006, then California Governor Arnold Schwarzenegger signed into law the California State Law Assembly Bill 32 (AB32). AB32 was the most ambitious subnational climate change legislation in the United States. The law authorized the California Air Resource Board (CARB) to develop a series of multi-sector market-driven and command-control regulations to reduce emissions of GHGs to 1990 levels by 2020.

AB32 has been phased-in with a scoping plan that was developed shortly after its passage (2008). The scoping plan helped to define a series of early actions that would take effect in 2010. It also set the stage for a series of mandatory reductions that came into force at the end of 2012. The mandatory reductions consisted of an emissions trading scheme that covered 85 percent of California's emissions sources. AB32 also included narrower provision targeting high global warming potential gases, energy efficiency, clean transportation, industry, forest and waste/recycling.

A macro-economic assessment of the overall economic impacts of AB32 was undertaken, including an analysis of energy savings and air pollution reductions. The assessment suggested that AB32 would reduce combustion-generated soot or $PM_{2.5}$ by 15 tons per day and NOx by 61 tons per day. The estimated benefits of these reductions included improvements in public health, estimated to be US$4.3 billion in 2020, 770 fewer premature deaths, and 76,000 fewer workdays lost (Climate Action Team, 2007).

> Many strategies to **reduce greenhouse gases** also have the **added co-benefit** of decreasing **health-damaging** air pollutants.

The inclusion of **air quality benefits** in the design of **climate strategies** can be used to **motivate** stakeholders **to take action** as AQ benefits are local, nearer term and **have direct health benefits**.

The transport sector is one area where co-benefits could be communicated both to key stakeholders and the general public. There are 'win-win' scenarios that benefit both air quality and climate (Figure 5.2). Box 5.6 discusses the co-benefits of introducing a bus rapid transit (BRT) system in Jakarta (Indonesia). Equally, under a 'win-lose- scenario' either climate or air quality would benefit, but not both (e.g. replacement of gasoline with biofuels which are beneficial for the climate but is detrimental to air quality due to increased particulate emissions) (EEA, 2013). Interventions to more active transport (i.e. walking and cycling), along with BRT/ public transport and improved land use, can result in reduced GHG emissions and offer immediate health co-benefits – e.g., a reduction in cardiovascular and respiratory disease from air pollution, less traffic injury and less noise-related stress. In contrast, shifting from gasoline to diesel vehicles could increase health-damaging particulate matter emissions (PM_{10}, $PM_{2.5}$).

When communicating co-benefits of air quality and climate change policies, it is important to do this in a coherent way, using a suite of metrics that connects the socioeconomic, environmental, and health information. Key messages will need to be identified to provide guidance and improve stakeholder awareness, especially at the city and regional level.

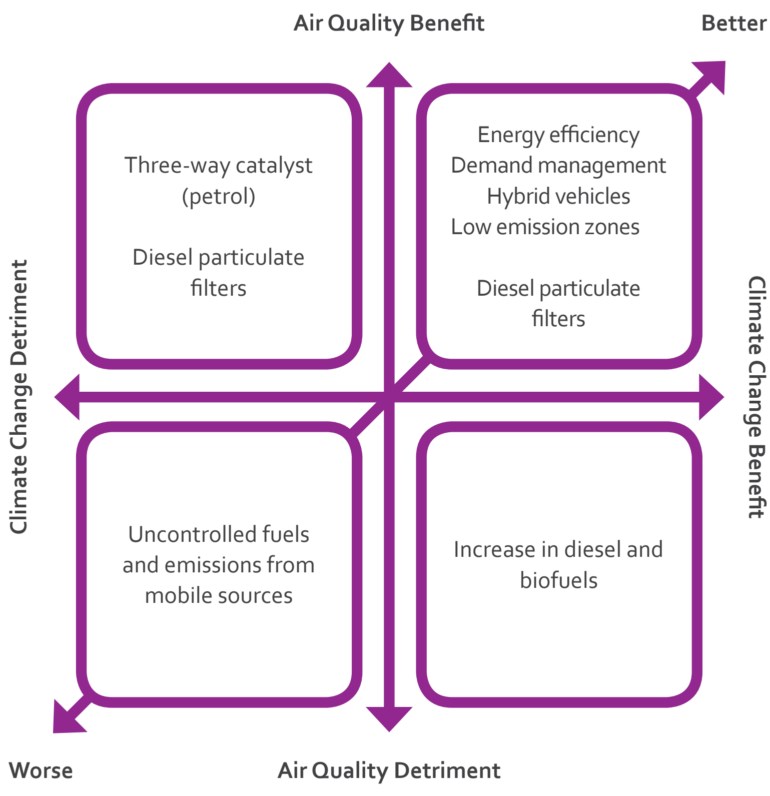
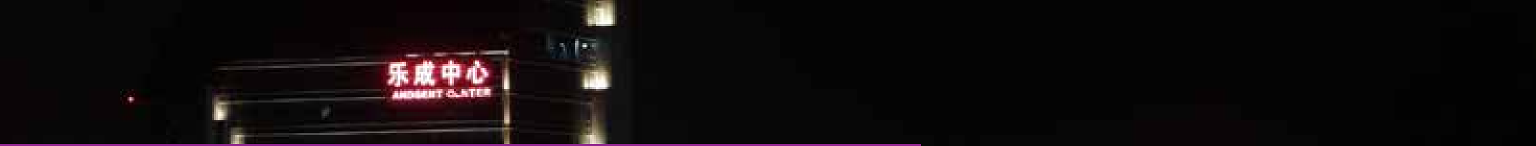


Figure 5.2: Air quality – climate change co-benefits in transport

Source: Adapted from EEA, 2013



Box 5.6
Co-benefits of bus rapid transit

Bus rapid transit (BRT) is a bus system that runs on a segregated lane, resembling an on road public rail system with elevated boarding stations, separate ticketing and other service amenities (Wright & Fulton, 2005). A BRT can generate multiple benefits, such as lower fuel costs, faster commuting times, and reduced CO_2 (Ernst, 2005). While BRTs first gained prominence in Latin America, their popularity has grown quickly in Asia.

One of the first BRTs to be introduced to Asia was in Jakarta, Indonesia. In early 2004, the first line of Jakarta's 15-line BRT system opened for business. There were several factors that made opening Jakarta's BRT possible – topmost of these was the need to replace the deteriorating quality and reduced ridership on Jakarta's previous bus system. Other factors included a US$1 million/km price tag that was significantly less than the US$50-200 million/km cost of rail. Also working in the BRT's favor was strong support from Jakarta's then popular Governor Sutiyoso.

By December 2007, Jakarta's BRT was making 208,332 trips and carrying an average of 1,874,988 passengers daily. Approximately 11 percent of the BRT's ridership came from private cars and 4 percent came from taxi riders, suggesting the BRT was responsible for 7,500 avoided car trips daily. The BRT saved passengers nearly one hour on its first line (12.9 km), reduced air pollution, and improved transport infrastructure. For just the first line of the BRT, it also helped mitigate about an estimated 32,256 tons of CO_2 per year (Sutomo et al., 2013).

For air quality communication **to be effective**, it needs to ensure that it **raises awareness**, **changes attitudes** and **fosters low-polluting behavior**. This will not only **improve air quality** but will ensure that **vulnerable groups are protected**.

5.2 Stages of air quality communication

For AQ communication to be effective, it needs to ensure that it raises awareness, changes attitudes, and fosters low-polluting behavior. This will not only improve AQ but will ensure that vulnerable groups are protected. Table 5.5 presents the different stages involved in the effective communication of AQ information, and associated health and co-benefits in Asian cities. It highlights the main indicators for each stage of AQM development, from underdeveloped to fully developed.

The key indicators for consideration include:

- Development and implementation of communication strategies (i.e. AQ communication plan)
- Availability of and access to AQ information (i.e. air quality monitoring data, health and other impacts, policies, action plans)
- Types of AQ information communicated
- Use of communication platforms to inform stakeholders about state of air quality

5.3 Issues and challenges

Several key challenges currently exist in Asia, which prevent the effective communication of AQ information. These can be identified under three broad headings:

Institutional

- **Limited capacity in processing AQ information**. Where AQ data is available, there may not be in-house capacity to use this data and develop awareness-raising programs to target different stakeholder groups.

Table 5.5 Stages of air quality communication

Stages	Indicators
Underdeveloped	There is limited raw/unprocessed AQ monitoring data available for communication activities. AQ data or any other relevant information is not shared with the public. There is limited public awareness of the need for understanding sources and health impacts of air pollution in AQM.
Developing	Limited AQ monitoring data (processed) data from ad hoc or project-based monitoring activities are used in communication activities. Available AQ information is not updated. Communication activities for policymakers and the public are implemented on an ad hoc or project basis. AQ data is available to the public through request. There is low level of public awareness of the need for understanding sources and health impacts of air pollution.
Emerging	Processed AQ monitoring data, AQI, and general information on pollution sources are used in communication activities. Available AQ information is updated but not on a regular basis. Press releases on the state of AQ are issued on a case-to-case basis. Advisories are made during events of high air pollution but no system is in place. Communication activities for policymakers and the public are becoming more common. Public can download general information on AQ online. One or two media channels are used to communicate AQ. Public awareness of the need for understanding sources and health impacts of air pollution is starting to become routinely considered.
Maturing	Processed AQ monitoring data, AQI, information on pollution sources from emissions inventory/ source apportionment (EI/SA), local data on impacts of air pollution and AQM action plans are used in communication activities. AQ information is updated on a regular basis. Press releases on the state of AQ are regularly issued. Advisories are systematically released during events of high air pollution. Communication strategies for policymakers and the public are developed and implemented; the process is institutionalized and systematized in AQM. Public can download more AQ information online (i.e. processed AQ monitoring data, AQ trends, health impacts). A wider selection of modern communication channels is used. Public awareness of the need for understanding sources and health impacts of air pollution is becoming standard.
Fully developed	Comprehensive and non-technical information on status of AQM (i.e. processed AQ monitoring data, AQI, more detailed information from EI/SA, local health impacts of air pollution, AQM policies and action plans to control air pollution for specific areas) are communicated to stakeholders on a regular basis. AQ information is updated on a real time basis. Press releases on the state of AQ are routinely used. Advanced public warnings/forecasts are accurately issued and system is in place to advice subsequent action. Communication strategies for policymakers and the public are developed and implemented; the process is institutionalized and systematized in AQM. Public can download information on state of AQ, local impacts (health, environmental, etc.), policies and action plans for specific areas online. Multiple communication channels and innovative solutions/technologies are utilized. Public awareness of the need for understanding sources and the health impacts of air pollution is extensive.

In order **to move towards** a fully developed **air quality communication program**, air quality information needs to be **clear**, comprehensive, **accurate**, precise, **understandable** and relevant to the concerns at hand.

Management/Technical

- **Limited dissemination and coverage of AQ information**. The availability of AQ data may be limited. If data is available, its scope, type and frequency may be restricted to certain cities/countries.
- **Differences in AQIs may lead to public confusion**. Differences between AQIs used by cities/regions and countries may cause the public to misinterpret the situation and reduce the impact of initiatives to reduce air pollution.
- **Limited public guidance on air pollution episodes**. Information on what the public should do to reduce exposure and emissions in a severe air pollution event may be unavailable.
- **Limited influence of AQ communication on attitudes and behavior**. Where public information is available, it may not be developed to have an impact on influencing the attitudes and behavior of different target audiences to reduce emissions and health impacts. This could be partly due to the poor understanding of influential groups – e.g., media and civil society – of air pollution issues.

Financial

- **Limited availability of financial resources for AQ communication**. Communication may be considered less important compared to identifying air pollution sources, determining the status of air quality, and assessing its impact on human health and wellbeing. However, in order to reduce pollution and protect public health, the communication of air pollution information should be seen as a key component of effective air quality management.

5.4 Roadmap for air quality communication

Air quality communication involves understanding the status of AQ, its sources and impact on human health. It is dependent on other components of AQM such as AQS and AQ monitoring. This information can be used to raise awareness of air pollution issues and foster voluntary behavioral change among key stakeholders.

Local government's management of polluting emissions from small businesses and domestic premises in the neighborhood, together with its role in urban planning, contribute to the state of regional and local AQ. Figure 5.3 provides examples of actions local government can take to improve local AQ. In addition, citizens can be encouraged to adopt behaviors that are low-polluting and reduce their exposure to pollutants during poor AQ alerts.

In order to move towards a fully developed AQ communication program, AQ information needs to be clear, comprehensive, accurate, precise, understandable and relevant to the concerns at hand (Table 5.6). The information should also provide some indication of reliability and uncertainty. Messages need to be directed at a specific target group, given at the right time and distributed through an appropriate channel. To do this, an AQ communication plan has to be formulated (Wartenberg, 2009; CiteAir, 2007). The detailed process of developing a clean air communication plan, along with information sources and case studies, is provided in **Annex IV of the *Information Sourcebook***.

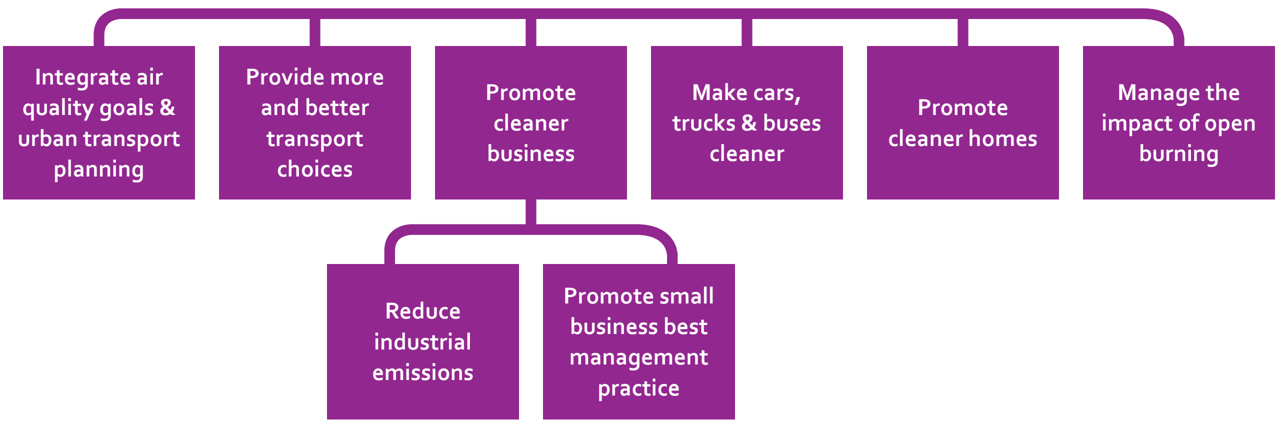


Figure 5.3 Local Government Actions on Air Pollution

Source: New South Wales Environmental Protection Agency (n.d.)

Table 5.6 Steps to follow to implement a roadmap for air quality communication

Developmental stages	Steps to follow
Underdeveloped	**Management Process** • Adopt AAQS (if none yet adopted) to mandate AQ monitoring [See *Guidance Area 1: Ambient air quality standards and monitoring*] • Build capacity for communicating AQ information to policymakers and the public **Technical Process** • Build capacity to measure, collate, and process AQ data from ad hoc or project-based monitoring activities for use in communication activities
Developing	**Management Process** • Enhance capacity to communicate AQ information to policymakers and the public in a more systematic way • Build capacity to issue ad hoc press releases on state of AQ and advisories during pollution episodes • Start building capacity for information technology to ensure online accessibility of general AQ information to the public **Technical Process** • Strengthen capacity to measure, collate, process, and update AQ monitoring data and general information on pollution sources for use in more regular communication activities • Develop capacity to use one or two media channels to communicate AQ Information • Adopt an AQI
Emerging	**Management Process** • Develop and implement communication strategies for policymakers and the public • Strengthen capacity to institutionalize and systematize AQ communication to policymakers, the public, and a wider range of stakeholders • Strengthen capacity to issue regular press releases on state of AQ and systematically release advisories during pollution episodes • Ensure that the public can access more AQ information online (i.e. processed AQ monitoring data, AQ trends, health impacts) • Ensure resources are available for AQ communication **Technical Process** • Strengthen capacity to measure, collate, process, and update processed AQ monitoring data, AQI, information on pollution sources from EI/SA, local data on air pollution health impacts, and AQM action plans for use in regular and systematic communication activities • Enhance capacity to use a wider selection of modern communication channels

Developmental stages	Steps to follow
Maturing	**Management Process** • Develop and implement communication strategies for all stakeholders • Strengthen capacity to institutionalize and systematize AQ communication to all stakeholders • Strengthen capacity to issue routine press releases on state of AQ • Systematically provide advance warnings/forecasts and public health hazards of air pollution impacts • Update AQ information online (i.e. processed AQ monitoring data, AQ trends, health impacts) and ensure accessibility to the public and all stakeholders • Ensure resources are available for AQ communication **Technical Process** • Strengthen capacity to communicate comprehensive and non-technical information on status of AQM (i.e. processed AQ monitoring data, AQI, more detailed information from EI/SA, local data on air pollution health impacts, and AQM action plans) for use in regular and systematic communication activities • Update AQ information on a real-time basis • Enhance capacity to use multiple communication channels and innovative technologies to communicate AQ Information
Fully developed	**Management Process** • Ensure proper implementation and review of communication strategies for all stakeholders; ensure feedback mechanism • Highlight co-benefits of AQ and GHG mitigation • Strengthen capacity to issue routine press releases on state of AQ • Systematically provide advance warnings/forecasts and public health hazards of air pollution impacts • Update AQ information on a real-time basis and make available online (i.e. processed AQ monitoring data, AQ trends, health impacts); ensure accessibility to the public and all stakeholders • Ensure resources are available to sustain AQ communication activities • Dedicate/assign staff position for public engagement/communication **Technical Process** • Strengthen capacity to communicate comprehensive and non-technical information on status of AQM through sustainable training (i.e. processed AQ monitoring data, AQI, more detailed information from EI/SA, local data on air pollution health impacts, and AQM action plans) • Ensure routine and systematic communication activities • Update AQ information on a real-time basis • Explore innovative solutions for AQ communication

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