



Ministerio del  
Medio  
Ambiente

Gobierno de Chile

## Manual on the Basic Set of Environment Statistics of the FDES 2013



# Air Quality Statistics

Topic 1.3.1 of the Basic Set of Environment Statistics of the FDES 2013

Álvaro Shee Smith ([ashee@mma.gob.cl](mailto:ashee@mma.gob.cl))

Ministry of the Environment of Chile

Division of Environmental Information and Economics

Department of Environmental Information

16 May 2018



# Contents



1. Statistics in Topic 1.3.1 Air Quality
2. Introduction/ Relevance
3. Definitions and description of the statistics
4. International sources and recommendations
  - 4A. Classifications and groupings
  - 4B. Reference to international statistical recommendations, frameworks and standards
  - 4C. Sources of global and regional environment statistics and indicators series
5. Data collection and sources of data
  - 6A. Potential presentation/dissemination formats
  - 6B. SEEA accounts/tables that use these statistics
  - 6C. Commonly used indicators that incorporate these statistics
  - 6D. SDG indicators that incorporate these statistics



# 1. Statistics in topic 1.3.1 Air Quality



<b>Component 1: Environmental Conditions and Quality</b>	
<b>Sub-component 1.3: Environmental Quality</b>	
<b>Topic 1.3.1: Air quality</b>	
<b>(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text</i> - Tier 3)</b>	
a.	Local air quality
	1. <b>Concentration level of particulate matter (PM<sub>10</sub>)</b>
	2. <b>Concentration level of particulate matter (PM<sub>2.5</sub>)</b>
	3. <b>Concentration level of tropospheric ozone (O<sub>3</sub>)</b>
	4. <b>Concentration level of carbon monoxide (CO)</b>
	5. <b>Concentration level of sulphur dioxide (SO<sub>2</sub>)</b>
	6. <b>Concentration levels of nitrogen oxides (NO<sub>x</sub>)</b>
	7. Concentration levels of heavy metals
	8. Concentration levels of non-methane volatile organic compounds (NMVOCs)
	9. <i>Concentration levels of dioxins</i>
	10. <i>Concentration levels of furans</i>
	11. Concentration levels of other pollutants
	12. Number of days when maximum allowable levels were exceeded per year
b.	Global atmospheric concentrations of greenhouse gases
	1. Global atmospheric concentration level of carbon dioxide (CO <sub>2</sub> )
	2. Global atmospheric concentration level of methane (CH <sub>4</sub> )



## 2. Introduction/Relevance

- This topic includes statistics on the ambient concentration of the most important air pollutants, including suspended solid particles, gases and other relevant pollutants that can have a negative effect on human and ecosystem health.
- Greenhouse gases and climate change.
- Air quality is measured at monitoring stations. Data availability varies according to the country's circumstances.
- This topic provides relevant information for public policy at national/subnational/local and international levels (air quality standards, SDGs, Green Growth, etc.)
- A large number of international organizations that publish statistics and indicators on concentrations of local and global pollutants

# 3. Definitions and description of the statistics



- General definitions:
  - Air quality
  - Air pollution
  - Primary/secondary air pollutants
  - Particulate pollutants
  - Gaseous air pollutants
  - Criteria pollutant
  - Standards

# 3. Definitions and description of the statistics

## Description of the statistics

- **Sources for the definitions:**

- WHO Air Quality Guidelines-Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.
- WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005, Summary of risk assessment .
- UNECE Standard Statistical Classification of Ambient Air Quality (1990).
- European Environment Agency
- USEPA Air Quality Planning and Standards.
- World Meteorological Organization (WMO)
- Agency for toxic substances and diseases (ATSDR)
- The United Nations Environment Programme (UNEP)
- Pan American Health Organization
- Clean Air Institute
- National Air Quality Legislations

# 3. Definitions and description of the statistics

- Description of the statistics:
  - General description
  - Statistical description
- **Example: 1.3.1.a.1 Concentration level of particulate matter (PM10)**
  - "Particulate matter", also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulphates), organic chemicals, metals, and soil or dust particles.
  - The size of particles is directly linked to their potential for causing health problems. Particles that are 10 micrometres in diameter or smaller generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.
  - "Coarse particles" such as those found near roadways and dusty industries, are larger than 2.5 micrometres and smaller than 10 micrometres in diameter.
  - Remarks:
    - PM10 measurements are reported as hourly concentrations they are normally aggregated to average concentrations of mobile 24-hour the short-term standards are daily values and annual particulate in the air, expressed in micrograms on cubic metre to normal pressure and temperature ( $\mu\text{g}/\text{m}^3$ ).
    - WHO guidelines:
      - » 20  $\mu\text{g}/\text{m}^3$  annual mean
      - » 50  $\mu\text{g}/\text{m}^3$  99th percentile (3 days/year)

# 4. International sources and recommendations

## 4.A Classifications and groupings



- UNECE Standard Statistical Classification of Ambient Air Quality (1990):
  - Concentrations in ambient air at:
    - impact stations
    - national/regional background stations
    - global background stations
- Main groups
  - Criteria Air Pollutants: CO, Lead, NO<sub>2</sub>, PM, SO<sub>2</sub>, O<sub>3</sub>.
  - Greenhouse Gases (GHG): CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, Fluorinated gases
  - Hazardous Air Pollutants: Benzene, methylene chloride, perchloroethylene
- Origin
  - Primary: SO<sub>2</sub>, NO<sub>2</sub>, CO, COV, Carbonaceous particles
  - Secondary: O<sub>3</sub>
- Scale: Local, Urban, Hemispheric and global scales





# 4. International sources and recommendations

## 4.B Reference to international statistical recommendations, frameworks and standards

- WHO Air Quality Guidelines. Global Update 2005. Particulate matter, ozone, nitrogen dioxide and sulphur dioxide
- WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Global Update 2005. Summary of risk
- WHO Air quality guidelines for Europa containing health risk assessments of 28 chemical air contaminants.
- World Meteorological Organization (WMO)
- *Regional initiatives*
  - United Nations Environment Programme(UNEP)
  - Pan American Health Organization
  - Air Pollution Information Network for Africa (APINA)
  - Cross Border Air Pollution Impact Assessment (CAPIA).
  - Southern African Regional Science Initiative (SAFARI 2000)
  - WHO (2005) *Air Quality Guidelines. Global Update 2005. Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.*
  - WHO (2005) *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Global update 2005. Summary of risk assessment.*
  - WHO(2000)Air Quality Guidelines for Europe. Second edition.

# 4. International sources and recommendations

## 4.C Sources of global and regional environment statistics and indicators series

- Global and regional:
  - WHO
  - World Bank
  - UNSTAT
  - OECD
  - EUROSTAT
  - EEA
  - ECLAC
  - UNEP
- National:
  - Ministries of the Environment
  - NSOs



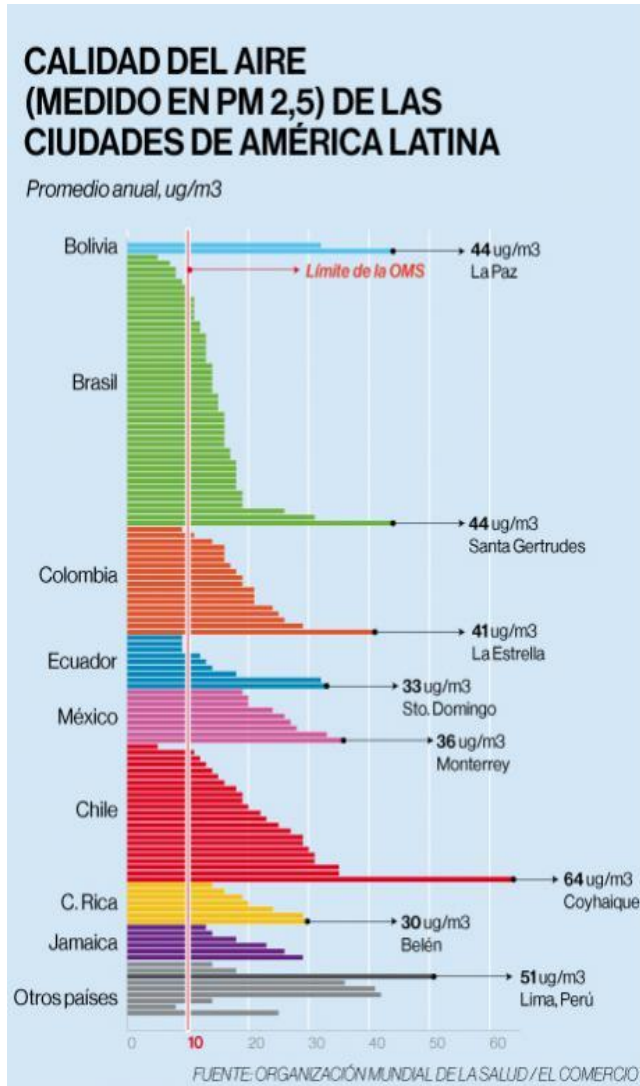
# 5. Transforming data into environment statistics

- **Scope:** Statistics on criteria pollutants that have a quality standard and have an effect on people's health. Other pollutants are also included, such as heavy metals, volatile organic compounds, dioxins and furans, as well as greenhouse gases (CO<sub>2</sub> and CH<sub>4</sub>).
- **Statistical unit:** the minimum is the monitoring station and can be aggregated by scale.
- **Measurement Unit:** µg/m<sup>3</sup>, PPB (parts per billion), PPM (parts per million).
- **Sources and institutions:**
  - raw data collected by monitoring stations -> in general by MoE
  - Validation procedures -> in general by MoE
  - statistics generation: measures of trend (median, mode, variance), measures of relative position (percentiles), dispersion measures (range, variance, standard deviation) and measures of association (correlation) -> in general by MoE and NSO.
- **Aggregation and disaggregation**
  - **Time:** hour, day, month, year. Ex.: Annual average, Percentile, Maximum eight hour daily mean
  - **Spatial:** Spatial interpolation; buffer zones

# 6. Uses and dissemination

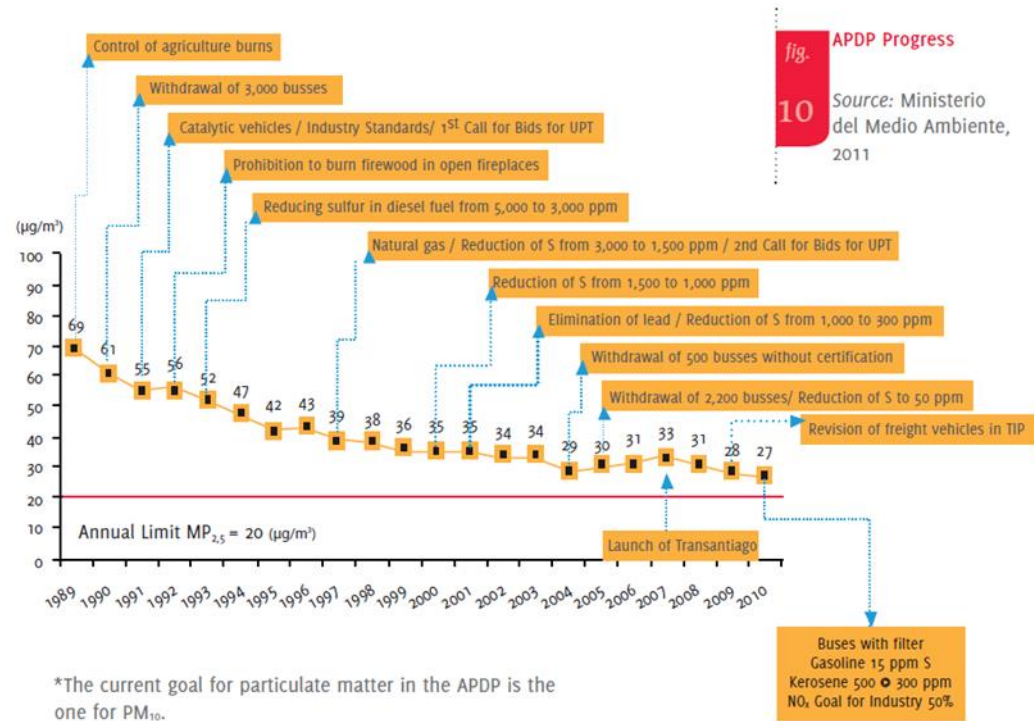
## 6.A Potential presentation/dissemination formats

Figure 6.1: Air quality (PM<sub>2.5</sub>) in Latin American cities



Source: WHO

Figure 6.2: Annual PM<sub>2.5</sub> average concentrations and progress of the Air Prevention and Decontamination Plan (APDP) in the Metropolitan Region of Chile

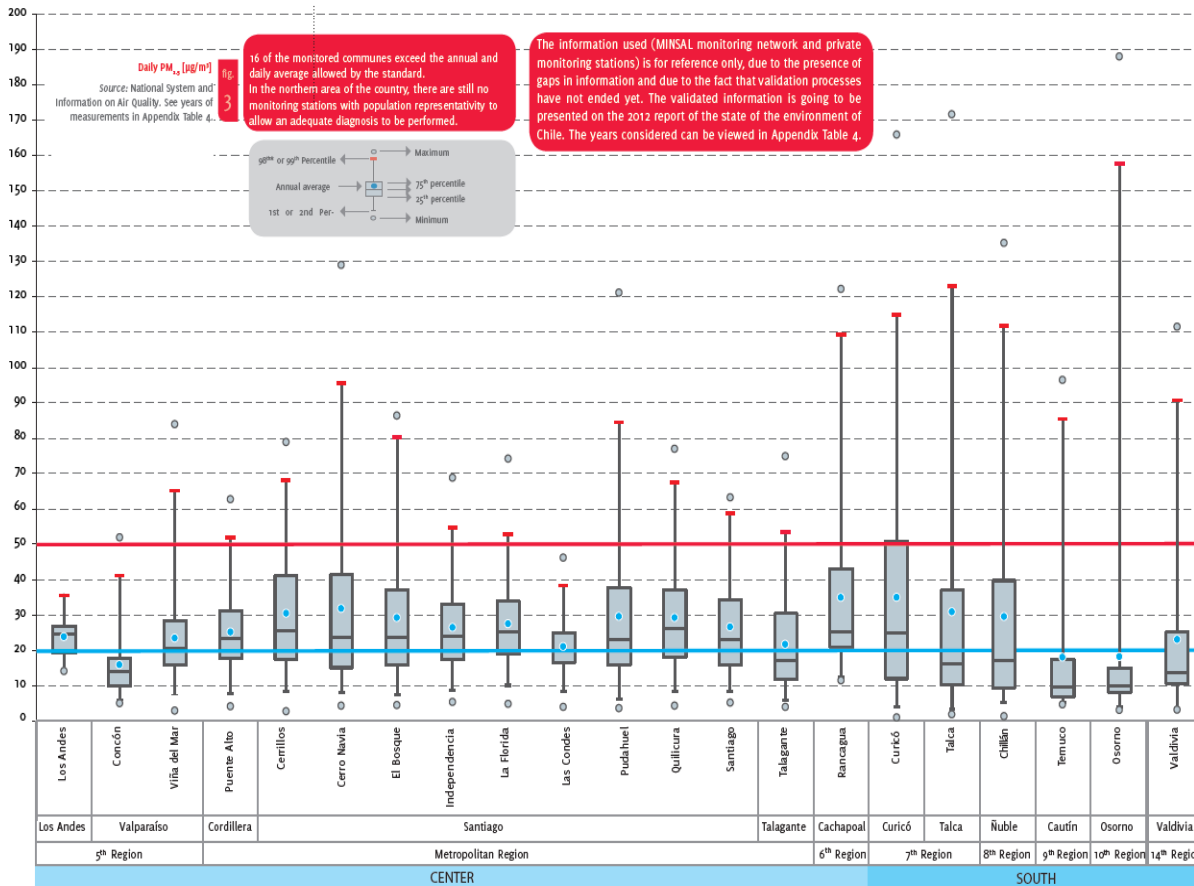


Source: Ministerio del Medio Ambiente, Chile (2011) *Informe del Estado del Medio Ambiente 2011*, <http://sinia.mma.gob.cl/wp-content/uploads/2017/08/Informe-del-estado-del-medio-ambiente.pdf> (accessed 02 April 2018)

# 6. Uses and dissemination

## 6.A Potential presentation/dissemination formats

Figure 6.1: Daily PM<sub>2.5</sub> average concentrations in communes of Chile

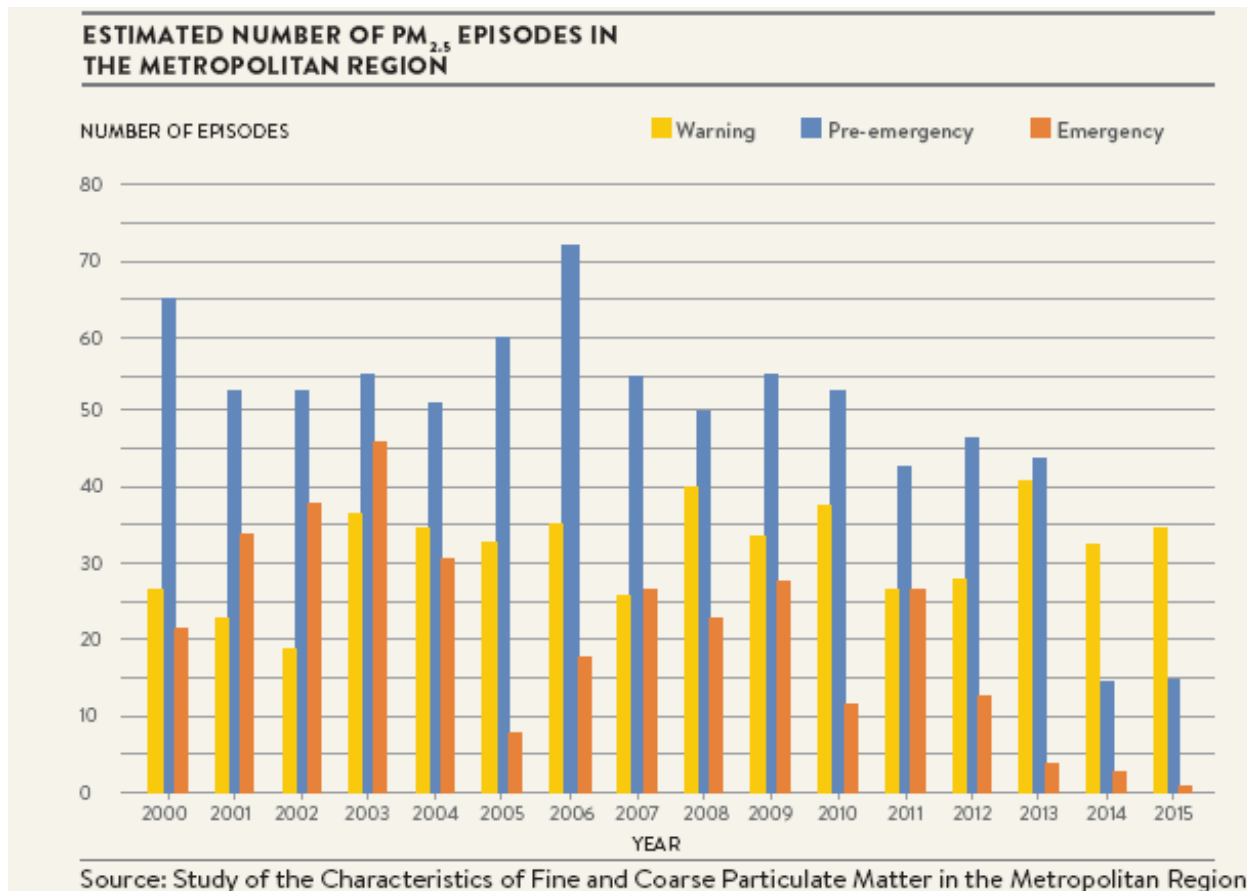


Source: Ministerio del Medio Ambiente, Chile (2011) *Informe del Estado del Medio Ambiente 2011*, <http://sinia.mma.gob.cl/wp-content/uploads/2017/08/Informe-del-estado-del-medio-ambiente.pdf> (accessed 02 April 2018)

# 6. Uses and dissemination

## 6.A Potential presentation/dissemination formats

Figure 6.1: Estimated number of PM<sub>2.5</sub> episodes in the Metropolitan Region, Chile

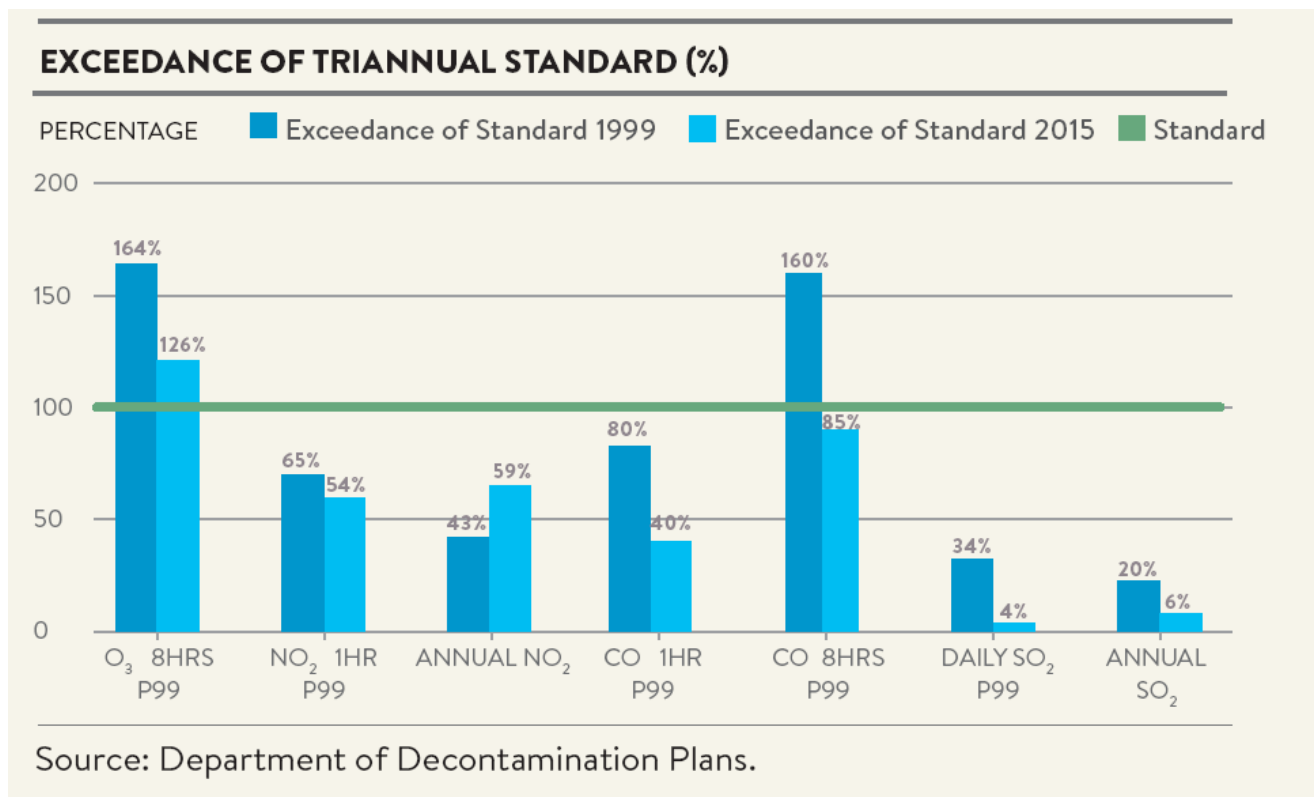


Source: Ministerio del Medio Ambiente, Chile (2016) *Informe del Estado del Medio Ambiente 2016*, <http://sinia.mma.gob.cl/wp-content/uploads/2017/08.IEMA2016.pdf> (accessed 02 April 2018)

# 6. Uses and dissemination

## 6.A Potential presentation/dissemination formats

Figure 1.6: Exceedance of triannual standard (%)

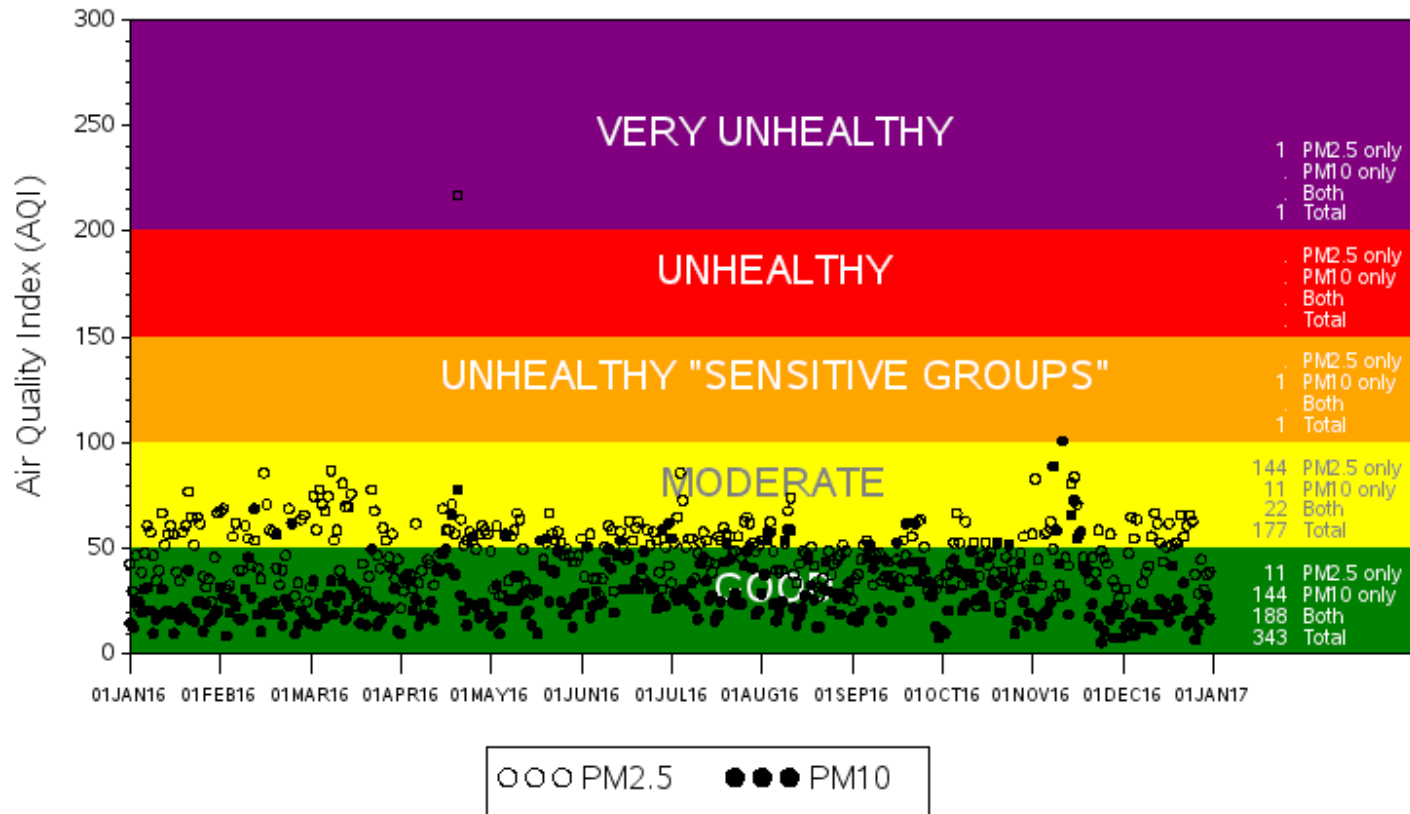


Source: Ministerio del Medio Ambiente, Chile (2016) *Informe del Estado del Medio Ambiente 2016*, <http://sinia.mma.gob.cl/wp-content/uploads/2017/08.IEMA2016.pdf> (accessed 02 April 2018)

# 6. Uses and dissemination

## 6.A Potential presentation/dissemination formats

Daily PM2.5 and PM10 AQI Values in 2016  
Chicago-Naperville-Elgin, IL-IN-WI



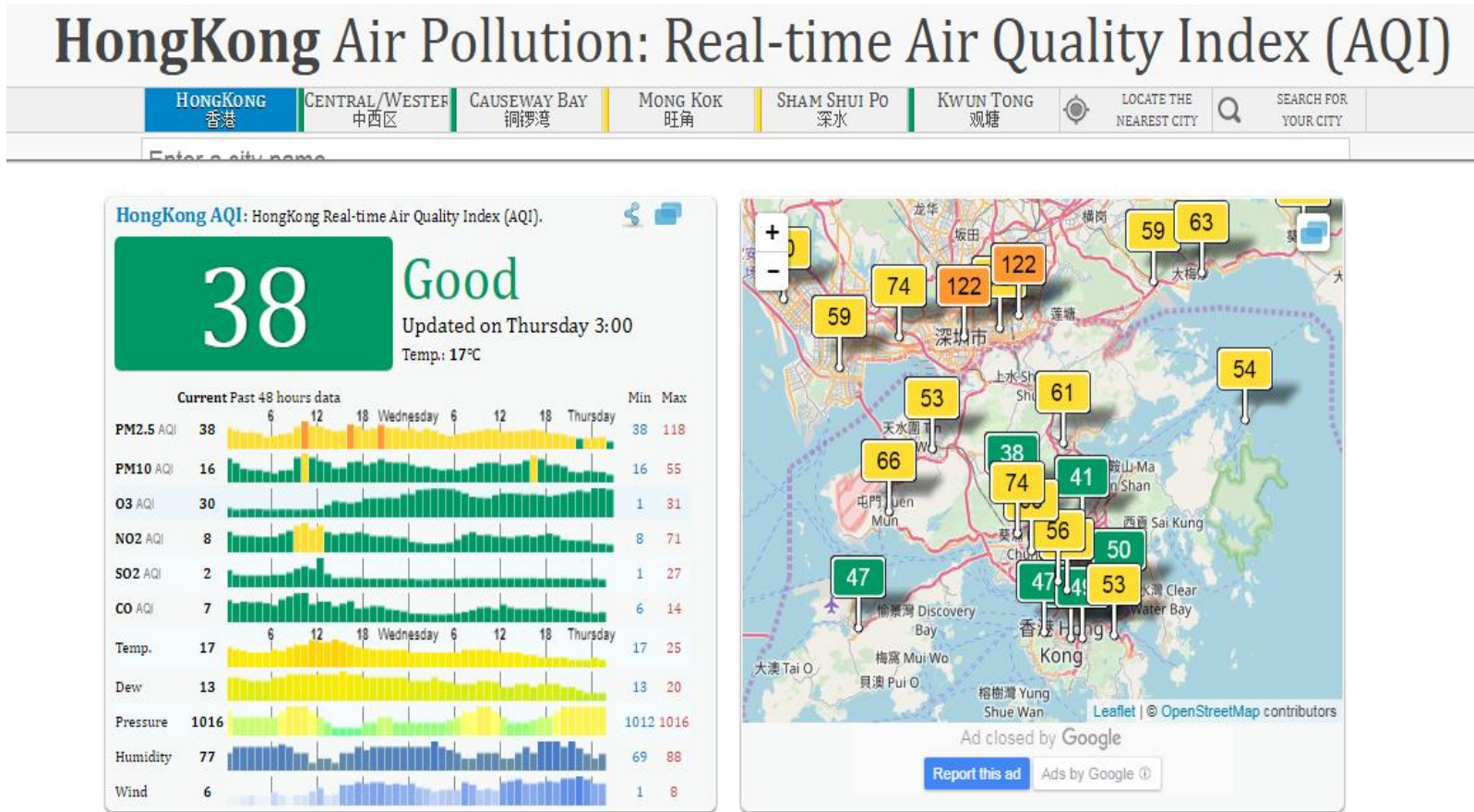
Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>



# 6. Uses and dissemination

## 6.A Potential presentation/dissemination formats

Figure 6.1: Real-time Hourly Air Quality Index (AQI) in Hong Kong



Source: Hong Kong Air Quality Index, by region <http://aqicn.org/city/hongkong/> (accessed 02 April 2018)

## 6. Uses and dissemination

### 6.B SEEA accounts/tables that use this statistic

- The SEEA Central Framework doesn't include air quality accounts (concentrations). But it includes emissions to the air (different FDES topic).
- The SEEA Experimental Ecosystem Accounting includes air filtration (clean air) and sequestering of carbon as ecosystem services.

**Table 3.2 Physical flows of ecosystem services for an EAU**

	Type of LCEU				
	Forest tree cover	Agricultural land*	Urban and associated developed areas	Open Wetlands	...
Type of ecosystem services (by CICES)					
Provisioning services	e.g. tonnes of timber	e.g. tonnes of wheat			
Regulating services	e.g. tonnes of CO <sub>2</sub> stored/released	e.g. tonnes of CO <sub>2</sub> stored/released	e.g. tonnes of CO <sub>2</sub> stored/released	e.g. tonnes of P absorbed	
Cultural services	e.g. number of visitors/hikers		e.g. hectares of parkland	e.g. hectares of duck habitat	

\* Medium to large fields rainfed herbaceous cropland

## 6. Uses and dissemination

- **6.C Commonly used indicators that incorporate this statistic**

- Concentrations of air pollutants: mean, percentile, maximum, daily average
- Exceedance of air quality limit values (standard)
- Air Quality Index
- Population exposure to air pollution
- OECD Green Growth Indicators: Exposure to air pollution:
  - Mean population exposure to PM<sub>2.5</sub> (micrograms per cubic metre)
  - Percentage of population exposed to more than 10 micrograms/m<sup>3</sup> (percentage)
  - Percentage of population exposed to more than 35 micrograms/m<sup>3</sup> (percentage)

- **6.D SDG indicators that incorporate these statistics**

- Indicator 3.9.1: Mortality rate attributed to household and ambient air pollution
- Indicator 11.6.2 Annual mean levels of fine particulate matter (e.g. PM<sub>2.5</sub> and PM<sub>10</sub>) in cities (population weighted)



**Thank you**

**Gracias**

Álvaro Shee Smith (ashee@mma.gob.cl)  
Ministry of the Environment of Chile  
Division of Environmental Information and Economics  
Department of Environmental Information  
16 May 2018