

5<sup>th</sup> International Forum on Sustainable Future in Asia  
5<sup>th</sup> NIES International Forum  
Public talk: Recent Environmental Issues faced in Asian Countries

# Development of Air Pollution Control Framework in Japan and Cooperation with Asian Countries

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(Materials are prepared mainly based on those from MOE Japan and partly modified or added by the presenter. Views shown here are the presenter's own ones.)

# Outline

1. History (Advance of measures)
2. Outline of Regulation
3. Environmental Quality Standards and Current Situation of Air Quality in Japan (SO<sub>2</sub>, SPM, NO<sub>2</sub>, Ox, PM2.5, Asbestos)
4. Emission Reduction from Automobiles
5. Cooperation with Asian Countries

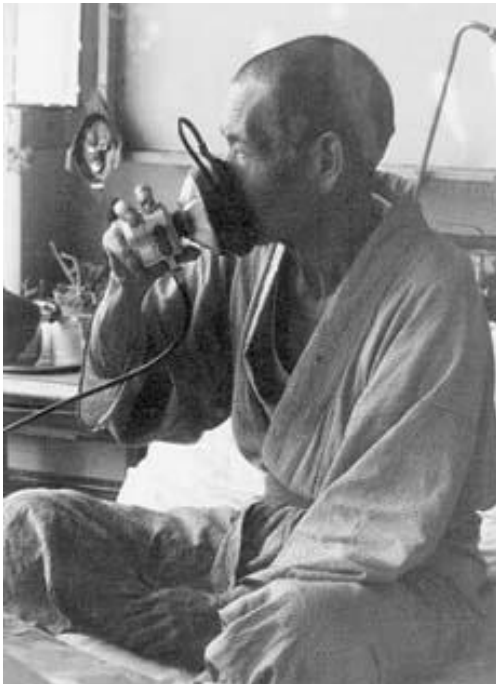
# History of Air Pollution and Health Damage

Mid-1950s to the first half of the 1970s (period of rapid economic growth): Air pollution caused by sulfur oxides due to industrialization initiated in many areas

1960s: Many people suffered from asthma in Yokkaichi City and other areas

1970s: Air pollution caused by automobiles became problematic

1980s and after: Variety of air pollutants and sources pointed out



# Advance of Measures

1962: Enactment of **the Smoke and Soot Law**: (Introduction of control of dust and smoke emission from factories in designated areas)

1967: Enactment of **the Basic Law for Environmental Pollution Control** (Clarification of pollutants emission responsibility and introduction of environmental quality standards)

1968: Enactment of the Air Pollution Control Act (Amendment of the Smoke and Soot Regulation Law)

(Further Amendments)

➤ 1970: Introduction of national uniform emission control & direct penalty

➤ 1978: Strengthen the automobile exhaust gas regulation (Japanese Muskie Act)

➤ 1989: Introduction of control of asbestos emission from facilities (further amendments made in 1996, 2006 and 2013 to strengthen the measures)

➤ 1996: Introduction of measures for hazardous air pollutants (HAP)

➤ 2006: Introduction of VOC emission control

➤ 2018: Introduction of BAT control of mercury emission

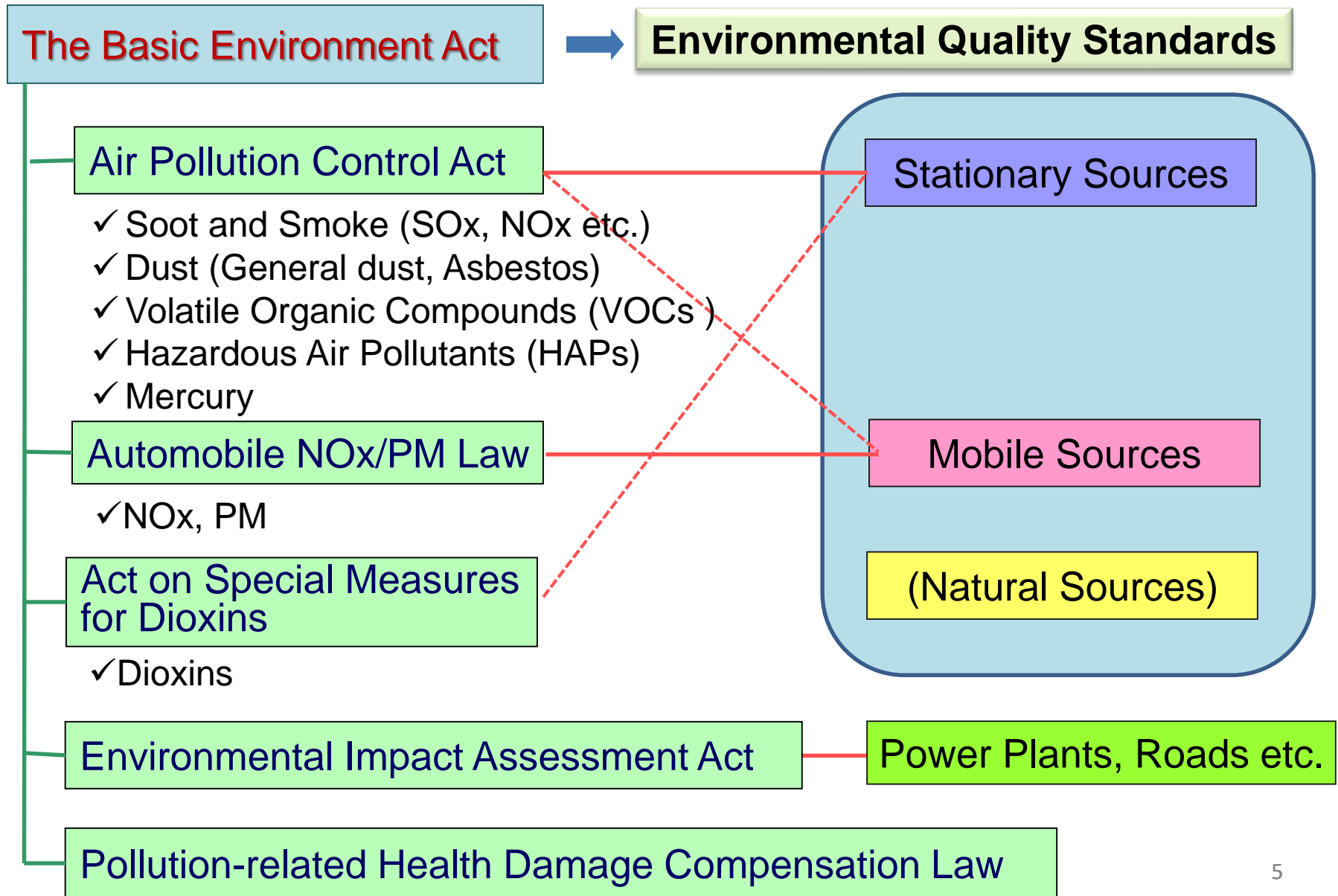
1992: Enactment of **the Automobile NOx Law** (Introduction of additional control of NOx emission from automobiles in designated areas)

➤ 2001: Amended to “**Automobile NOx/PM Law**” to include the measures for PM

2000: Enactment of **the Act on Special Measures for Dioxin**

2005: Enactment of **the Off-Road Vehicles Law**

# Major Laws Related to Air Pollution



# Environmental Quality Standards (EQSs) for Air (1)

Substance	Environmental Requirements	Year
Sulfur Dioxide (SO <sub>2</sub> )	average of hourly values for each day* : 0.04 ppm or less hourly values** : 0.1 ppm or less	1973
Nitrogen Dioxide (NO <sub>2</sub> )	average of hourly values for each day* : between 0.04 ppm and 0.06 ppm, or less	1978***
Suspended Particulate Matter (SPM)	average of hourly values for each day* : 0.10 mg/m <sup>3</sup> or less the hourly values** : 0.20 mg/m <sup>3</sup> or less	1972
Carbon Monoxide (CO)	average of hourly values for each day* : 10 ppm or less each eight-hour average of the hourly values** : 20 ppm or less	1970
Photochemical Oxidants (Ox)	hourly values** : 0.06 ppm or less	1973
Fine Particulate Matter (PM <sub>2.5</sub> )	yearly average values : 15µg/m <sup>3</sup> or less daily average values* : 35µg/m <sup>3</sup> or less	2009

\* Achievement of AQS is judged comparing with the annual 98th percentile value.

\*\* Achievement of AQS is judged comparing with the annual maximum value.

\*\*\* An original standard was set in 1973 as “average of hourly values for each day : 0.02 ppm or less

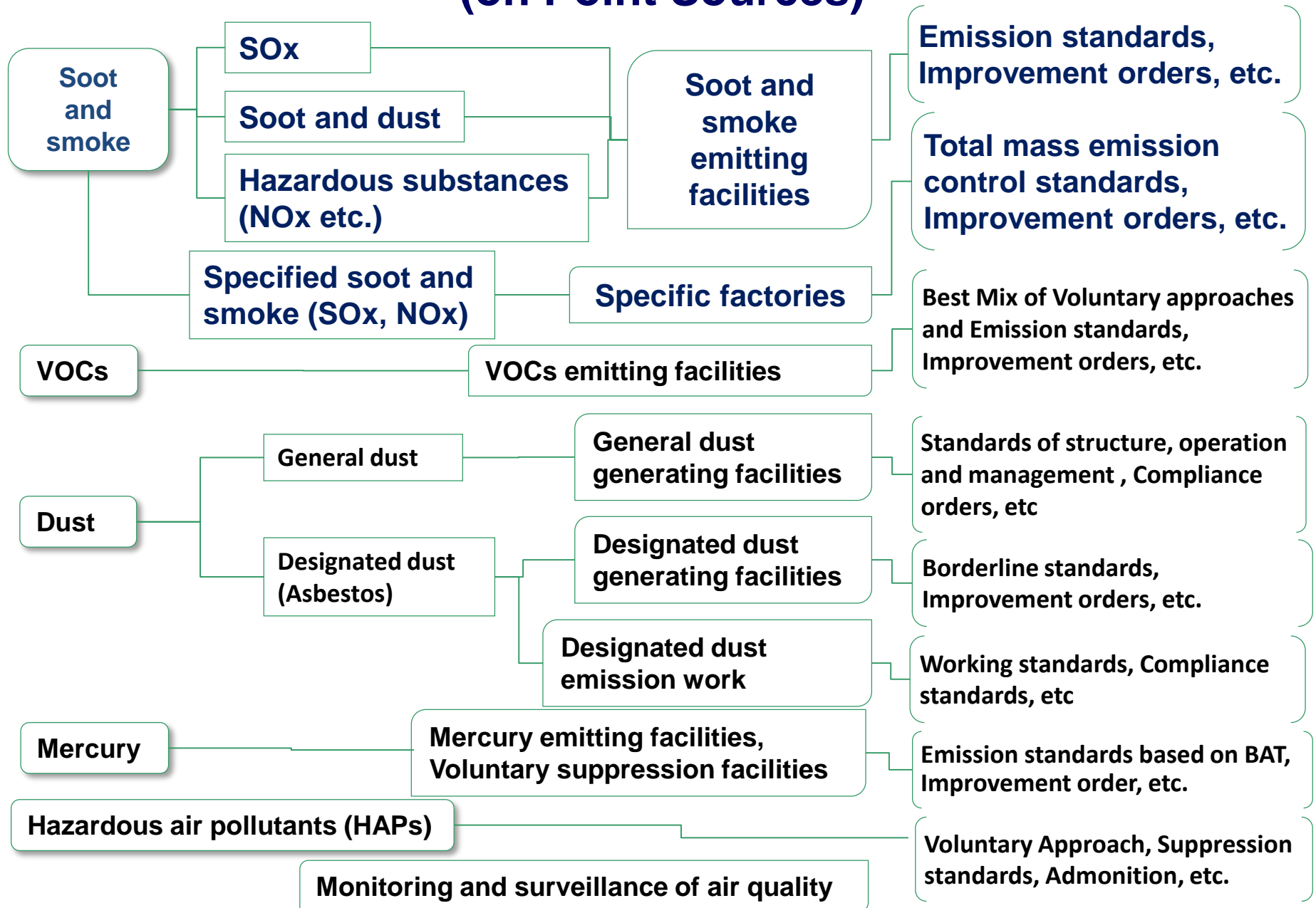
# Environmental Quality Standards (EQSs) for Air (2)

## (on Hazardous Air Pollutants (HAPs))

Substance	Environmental Requirements	Year
Benzene	yearly average value : 0.003 mg/m <sup>3</sup> or less	1997
Trichloroethylene	yearly average value : 0.13 mg/m <sup>3</sup> or less (Original: 0.2 mg/m <sup>3</sup> or less (1997) => amended)	2018
Tetrachloroethylene	yearly average value : 0.2 mg/m <sup>3</sup> or less	1997
Dichloromethane	yearly average value : 0.15 mg/m <sup>3</sup> or less	2001
Dioxins	yearly average value : 0.6 pg-TEQ/m <sup>3</sup> or less	1999

- ppm (parts per million): A unit indicating concentration or proportion. 1 ppm means one part per million (= 10<sup>-6</sup>).
- pg = 10<sup>-12</sup>g (one trillionth of a gram)
- TEQ (toxicity equivalent): A unit that expresses the virulence of all kinds of dioxins by converting their toxicity to that of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).
- With regard to HAPs, guideline values have been determined on 9 substances, for which uncertainty cannot be neglected on risk assessment.

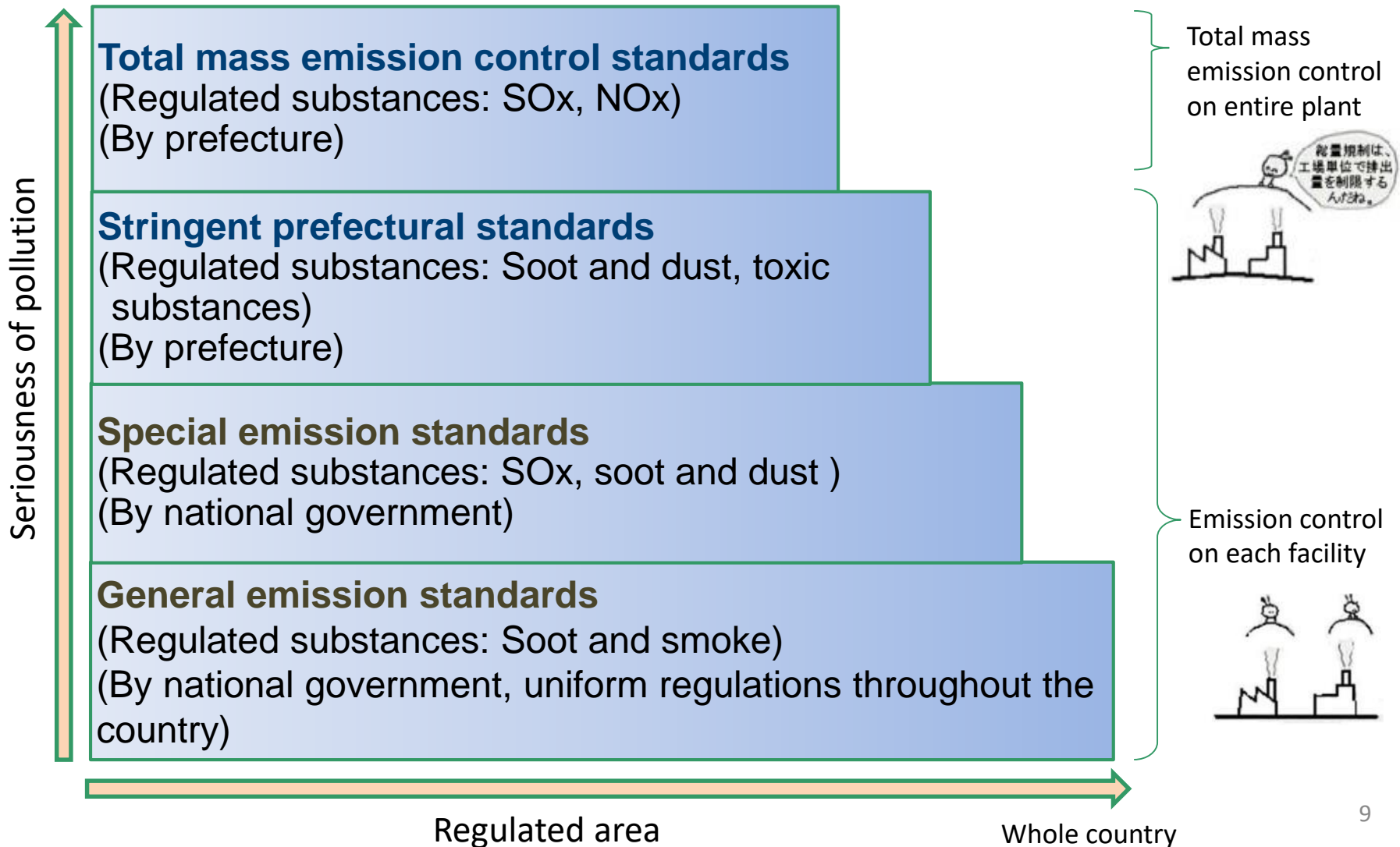
# Framework of Air Pollution Control Act (on Point Sources)





# ◆ Emission Control for Soot and Smoke

**Regulated substances:** Sulfur oxides (SOx), Soot and dust, Hazardous substance (Nitrogen oxide (NOx), Cadmium, etc.)



# Various Measures and Roles Stipulated in the Air Pollution Control Act

## Monitoring

- Monitor in atmosphere and make the results publicly available  
Radioactive matter; national government  
The other air pollutants; local governments\*

## Emergency by local governments\*

- Warning or Alerts (SO<sub>x</sub>, O<sub>x</sub>, etc.)

## Checking by local governments\*

- On-site inspection
- Administrative disposition (order for improvement or suspension)

## Research by national government for HAPs

- Implement studies, advance scientific knowledge, evaluate the risk and its publication, collect information on technologies and distribute it

Endeavor to suppress the emission of VOCs by private sectors and citizens

\* local governments: prefectures or designated municipalities

# Monitoring System

## Local Governments

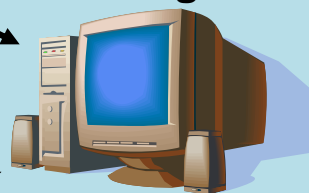
Ambient air quality monitoring stations

1,464 stations  
(As of Mar. 2018)

Roadside air quality monitoring stations

409 stations  
(As of Mar. 2018)

Data collection & monitoring

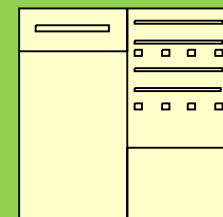


## National Government

Terminal



Server



Internet

- Real-time publication of monitoring results on the Internet
- Effective transmission of warning announcements

“Soramame kun”



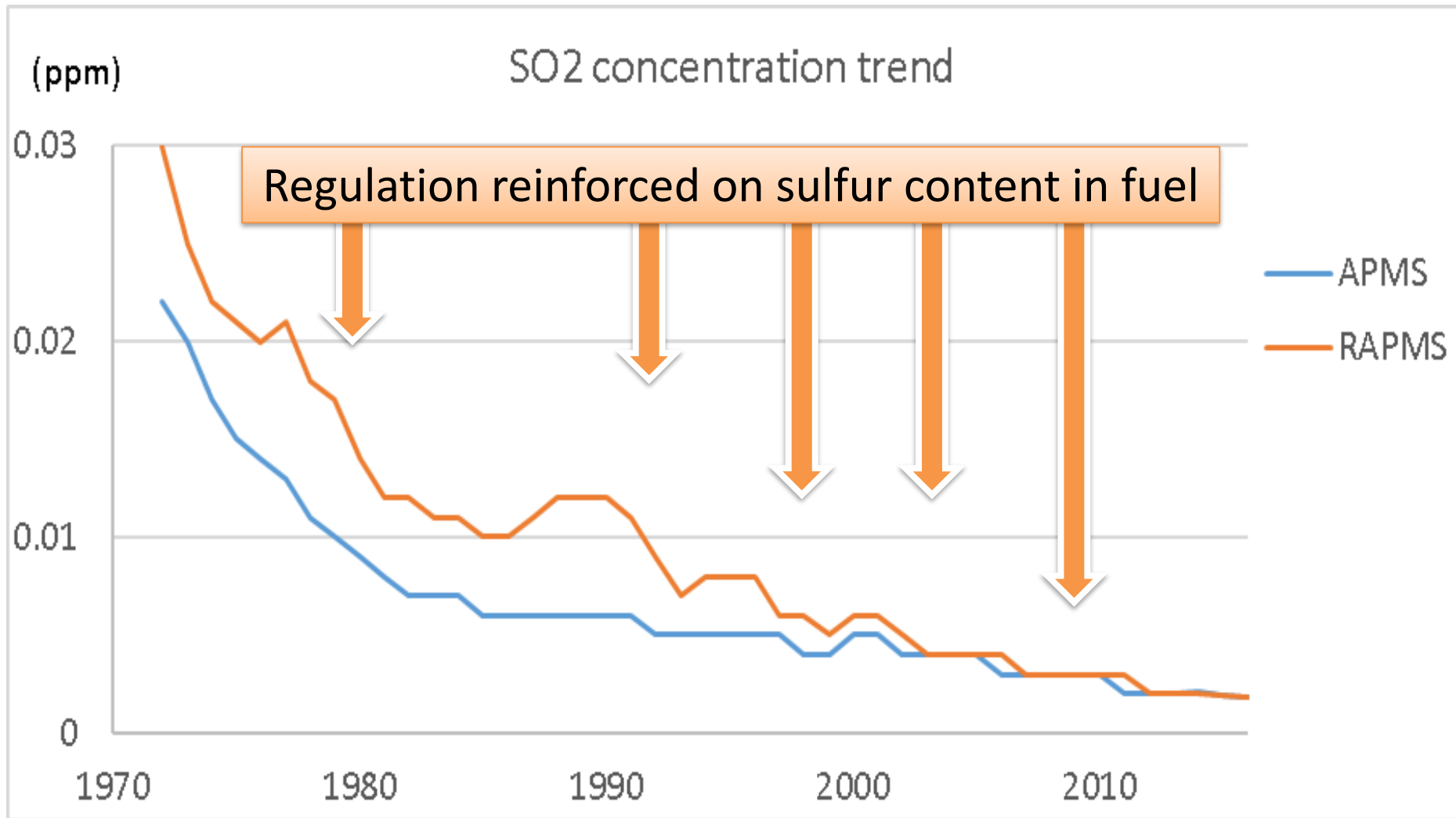
# Current Air Quality

- Concentrations of almost all air pollutants are already low
- For PM2.5 and Ox, EQSs have not been achieved sufficiently.

Substance	Yearly average value (2016 FY)	Achievement rate of AQS
Sulfur Dioxide (SO <sub>2</sub> )	0.002 ppm	100%
Nitrogen Dioxide (NO <sub>2</sub> )	0.009 ppm	100%
Suspended Particulate Matter (SPM)	0.017 mg/m <sup>3</sup>	99.6%
Carbon Monoxide (CO)	0.3 ppm	100%
Photochemical Oxidants (Ox) *	0.047 ppm	0.1%
Fine Particulate Matter (PM2.5)	11.9 µg/m <sup>3</sup>	88.7%
Benzene	0.78 µg/m <sup>3</sup>	100%
Trichloroethylene	0.37 µg/m <sup>3</sup>	100%
Tetrachloroethylene	0.11 µg/m <sup>3</sup>	100%
Dichloromethane	1.2 µg/m <sup>3</sup>	100%
Dioxins	0.021 pg-TEQ/m <sup>3</sup>	100%

\* Ox value 0.047 ppm is yearly average of daytime maximum 1-hour values

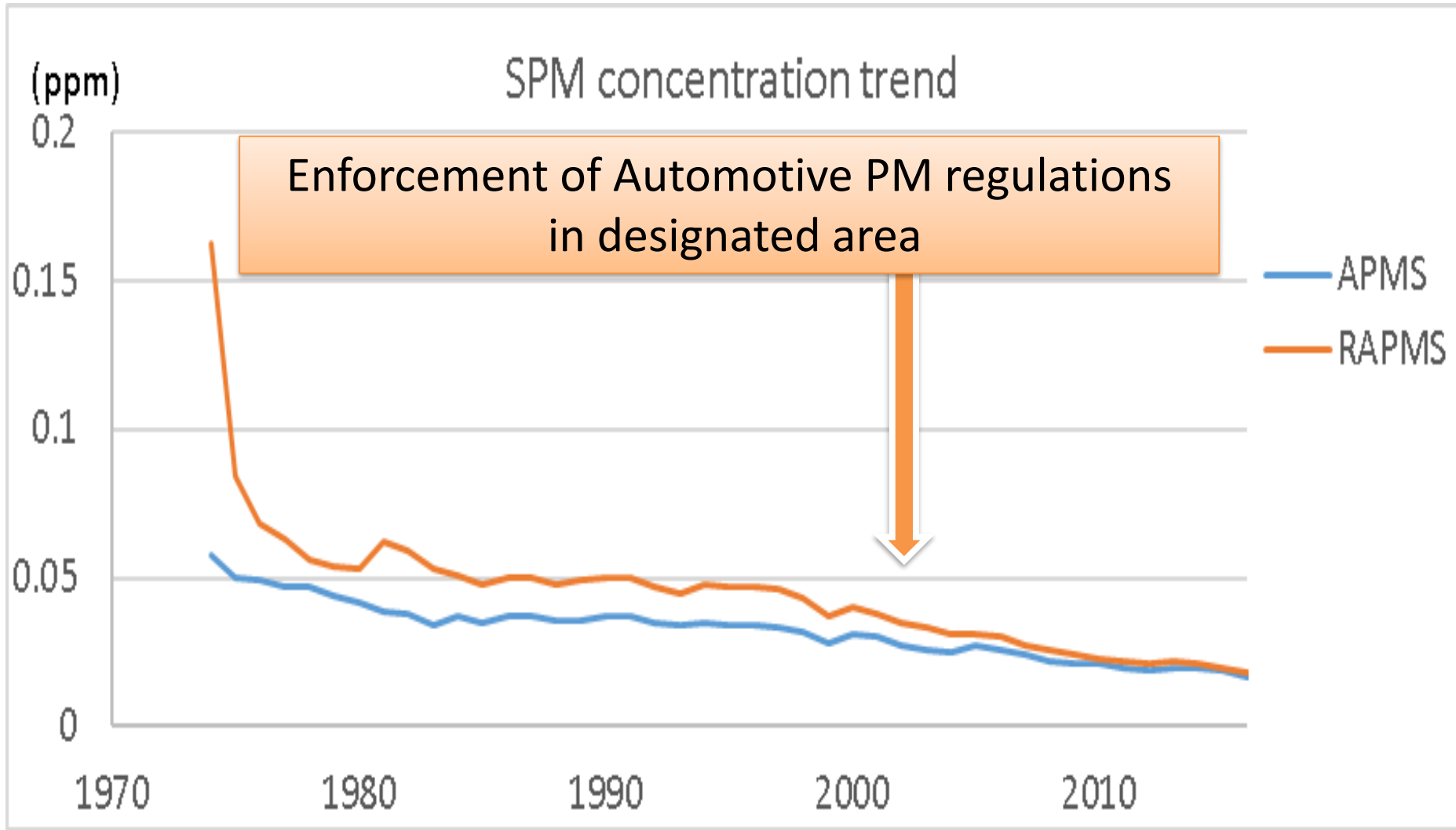
# SO<sub>2</sub>



**APMS**; Ambient air pollution monitoring station

**RAPMS**; Roadside air pollution monitoring station

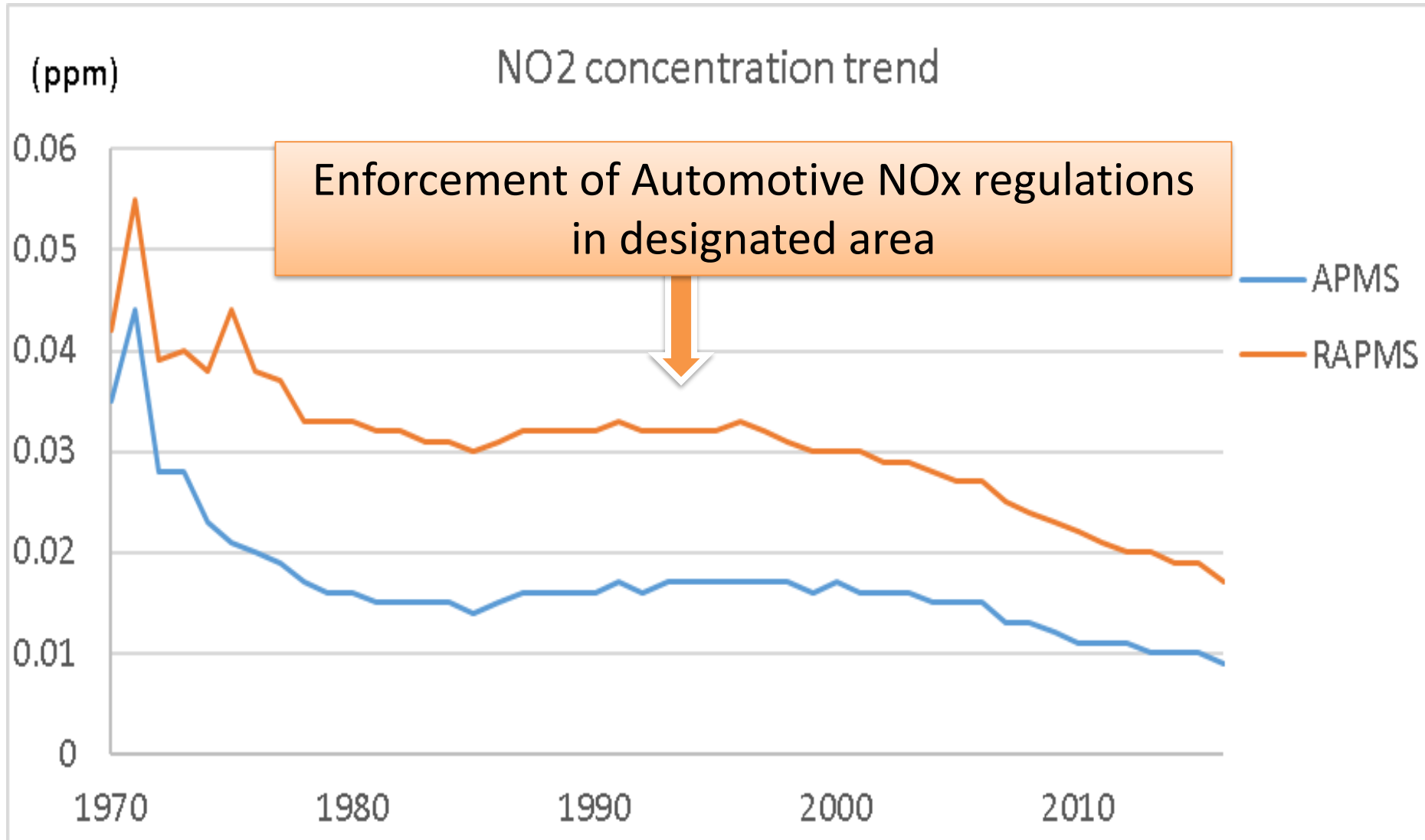
# SPM



**APMS**; Ambient air pollution monitoring station

**RAPMS**; Roadside air pollution monitoring station

# NO<sub>2</sub>

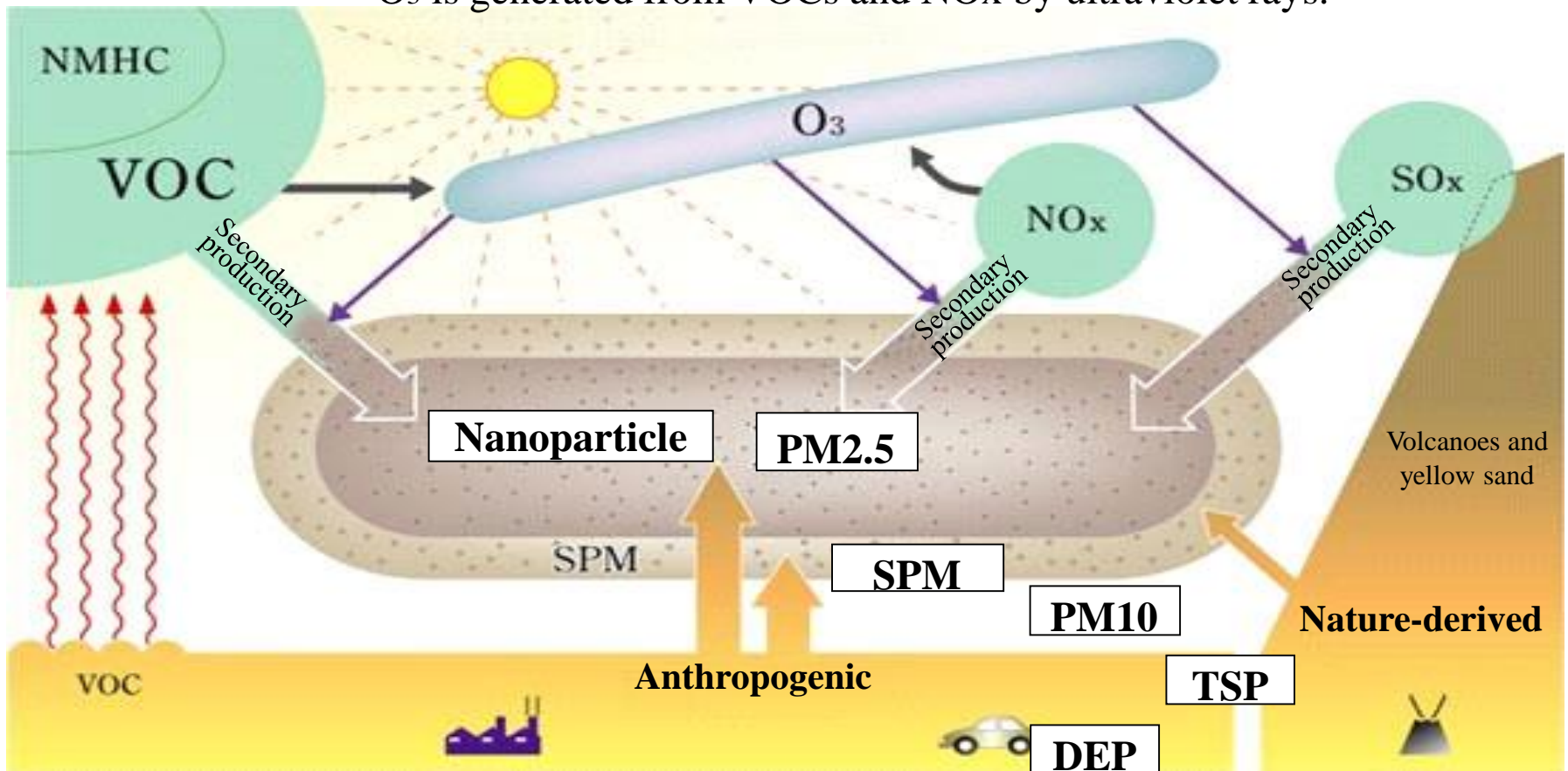


**APMS**; Ambient air pollution monitoring station

**RAPMS**; Roadside air pollution monitoring station

# Chemical Reaction in the Air

O<sub>3</sub> is generated from VOCs and NO<sub>x</sub> by ultraviolet rays.



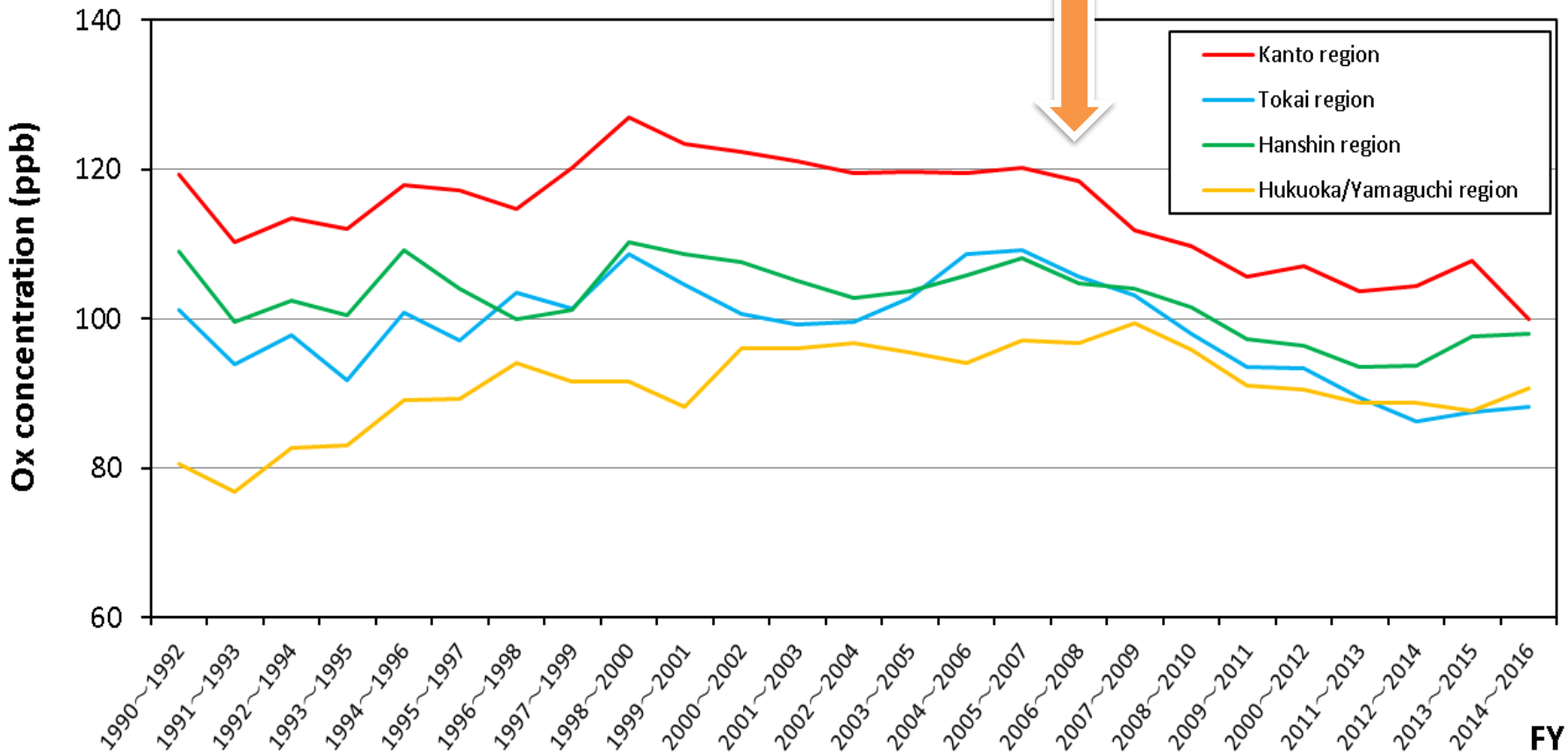
Excerpts from materials of the National Institute for Environmental Studies



# Ox

## Change in 3-Year Moving Average Figures of Ox (99% of the maximum daily 8-hour values for the year)

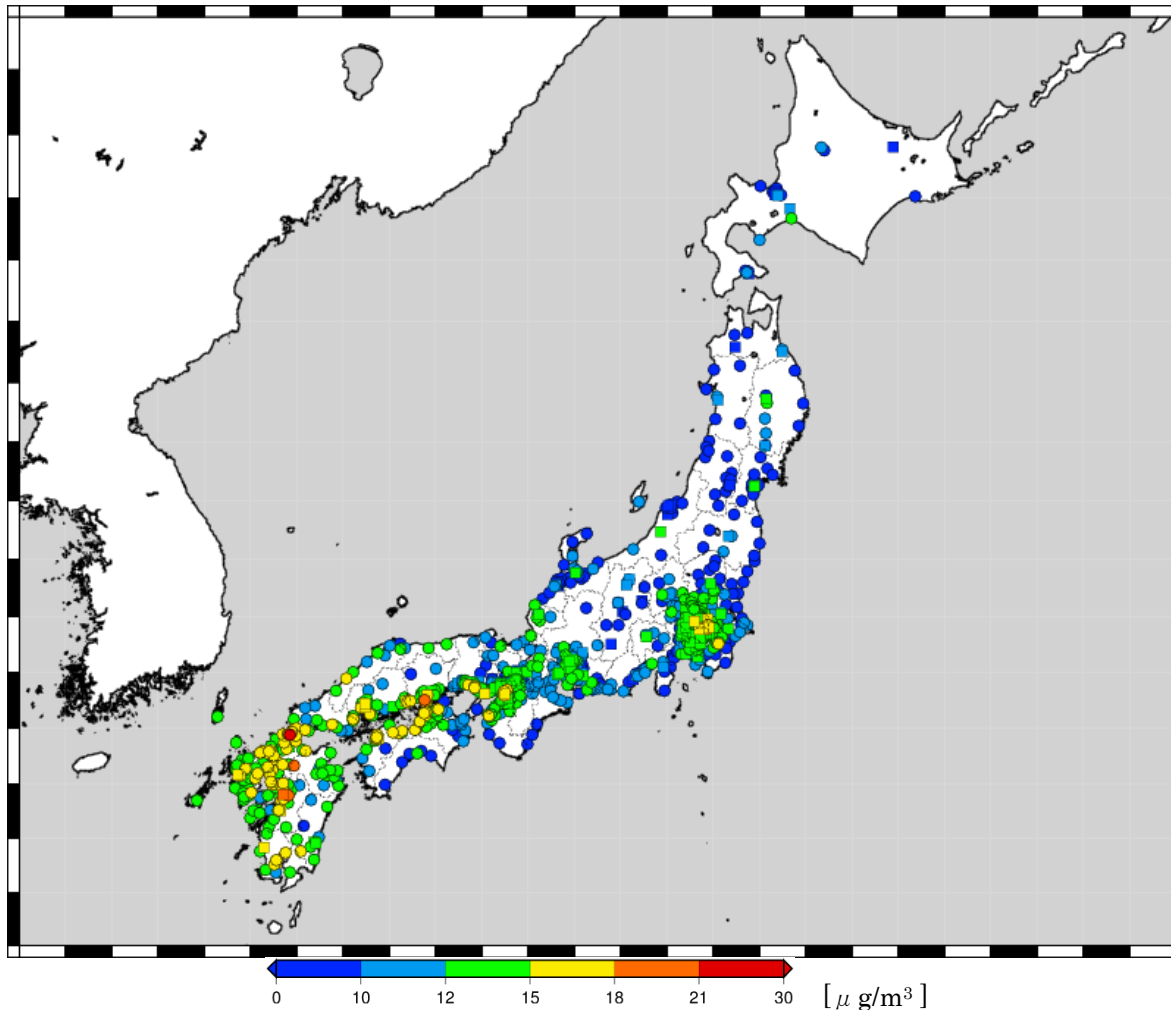
Enforcement of VOC regulations



# PM2.5

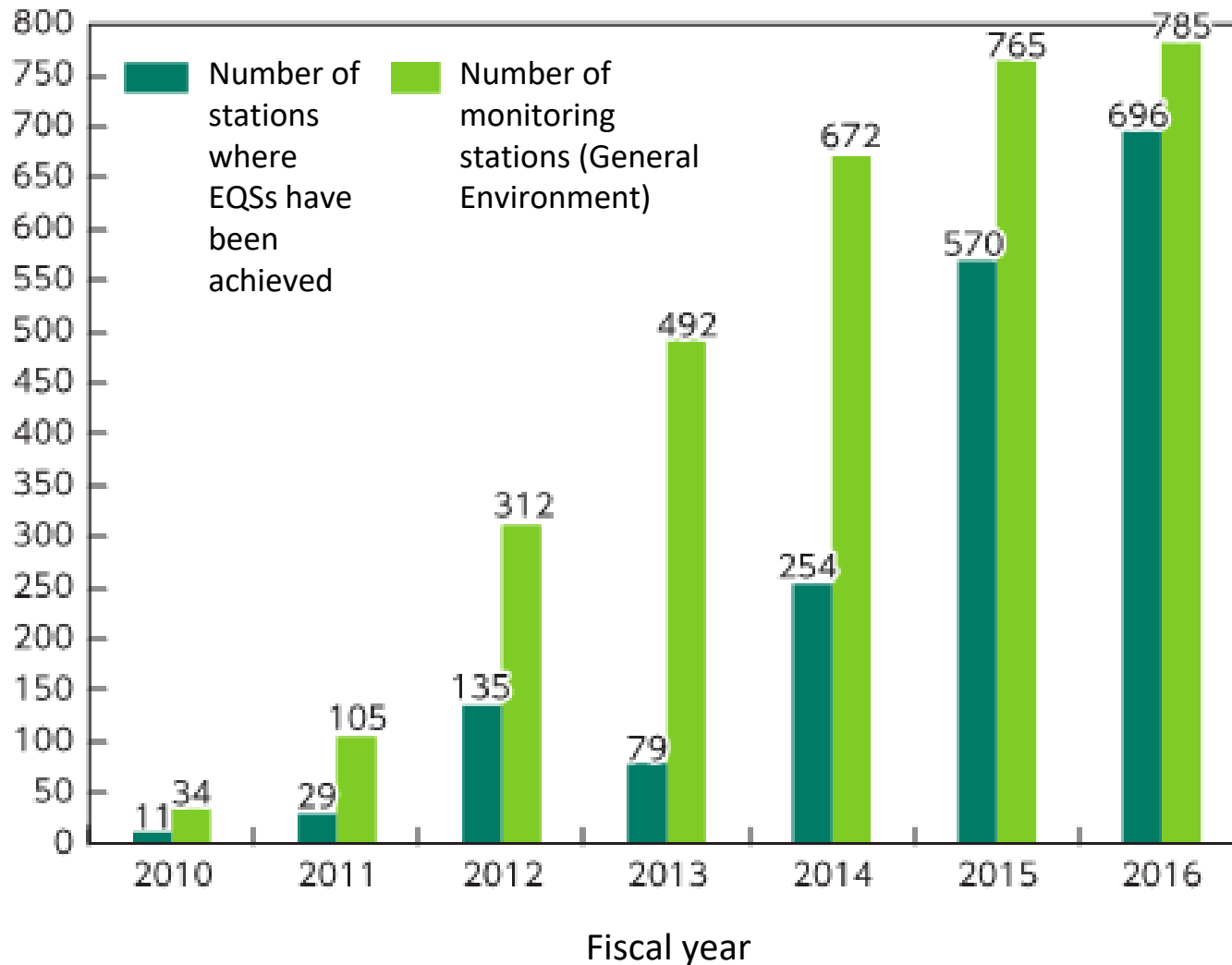
PM2.5 has changed from nationwide problem to regional/local problem.

## Regional Distribution Map of PM2.5 yearly average value in FY 2016



# Achievement of EQSs for PM2.5

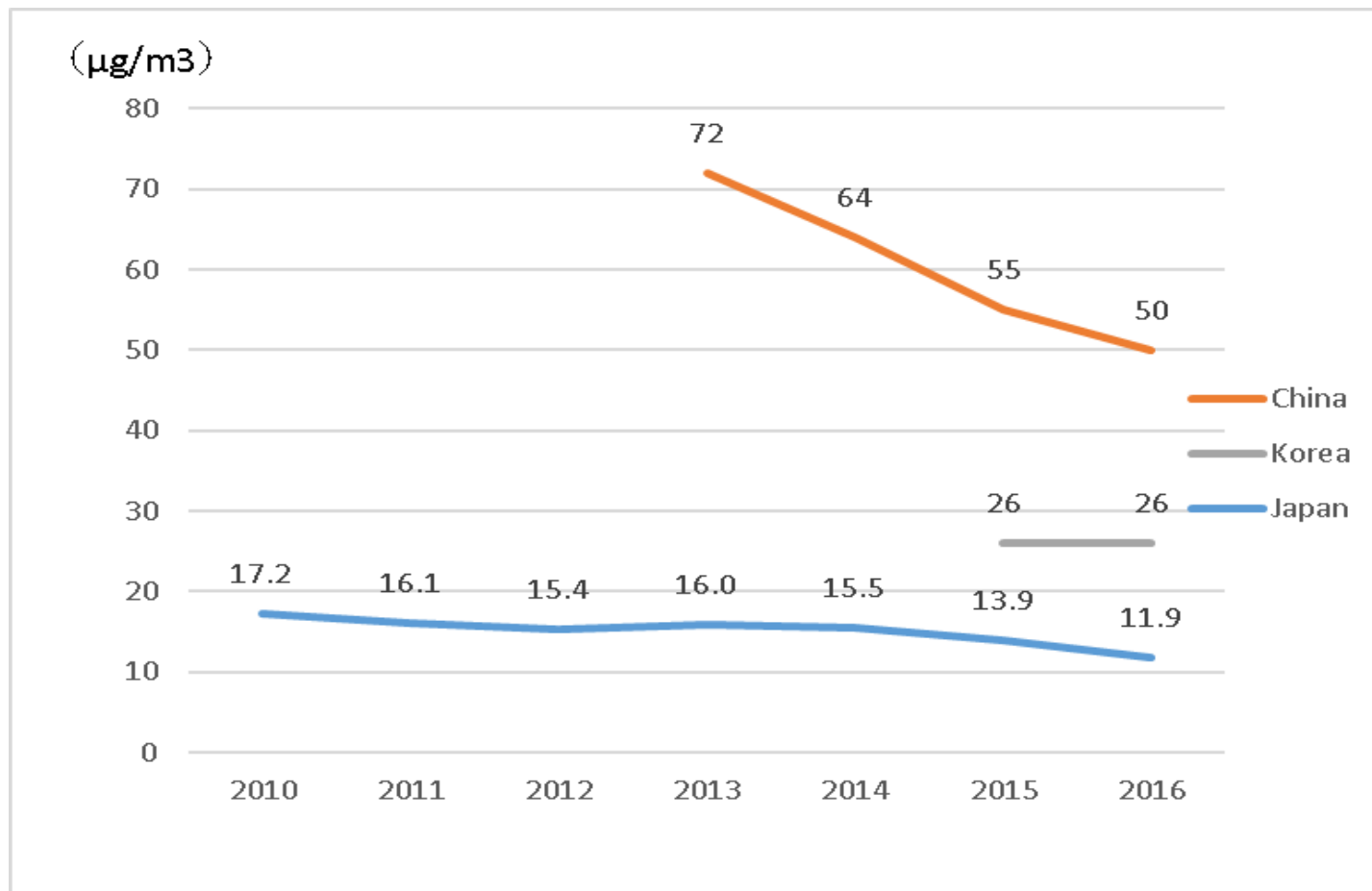
Number of stations



# Current Air Quality (PM2.5)

- Recently, PM2.5 in China has been reduced drastically.

## PM2.5 yearly average values in China, Japan, Korea



- Average of almost all Japanese cities and 74 Chinese cities
- [Data source] Publication data of each government

# Comprehensive Efforts to Reduce PM2.5 (Dec. 2013)

## Goal 1

To secure the safety and reassurance of our nation

- ✓ Improvement of forecast/prediction accuracy
- ✓ Issuance of alerts

## Goal 2

To achieve Air Quality Standards

- ✓ Phenomenon clarification on PM2.5
- ✓ Review and formulate reduction measures

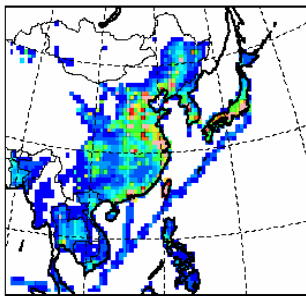
## Goal 3

To share clean air among the whole Asian region

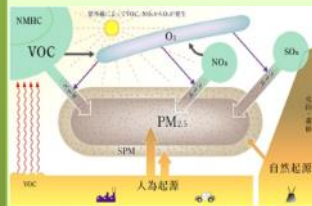
- ✓ Promotion of collaboration in the region

## Projects serving as a foundation for these efforts

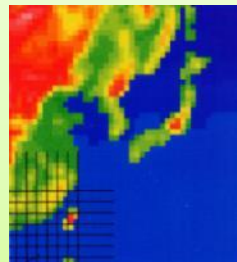
- ✓ Accumulation of Source Information



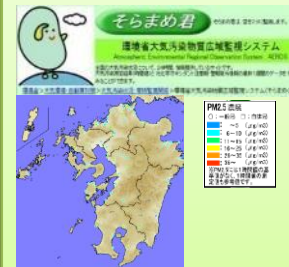
- ✓ Clarification of Secondary Generation Mechanism



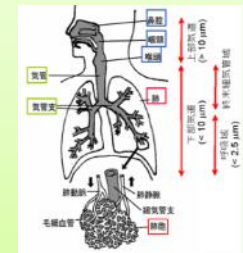
- ✓ Building of Simulation model



- ✓ Enhancement of environmental air quality monitoring



- ✓ Accumulation of information on Health effects



# Control of VOC

- **Volatile Organic Compounds**

- Some 200 kinds of compounds (e.g. toluene, xylene, ethyl acetate, etc.)
- Contained in solvents (thinner) used for paints, adhesives, ink, etc.
- One of the **causative substances of PM2.5 and Ox.**

**Statutory regulation**  
(for bigger facilities)

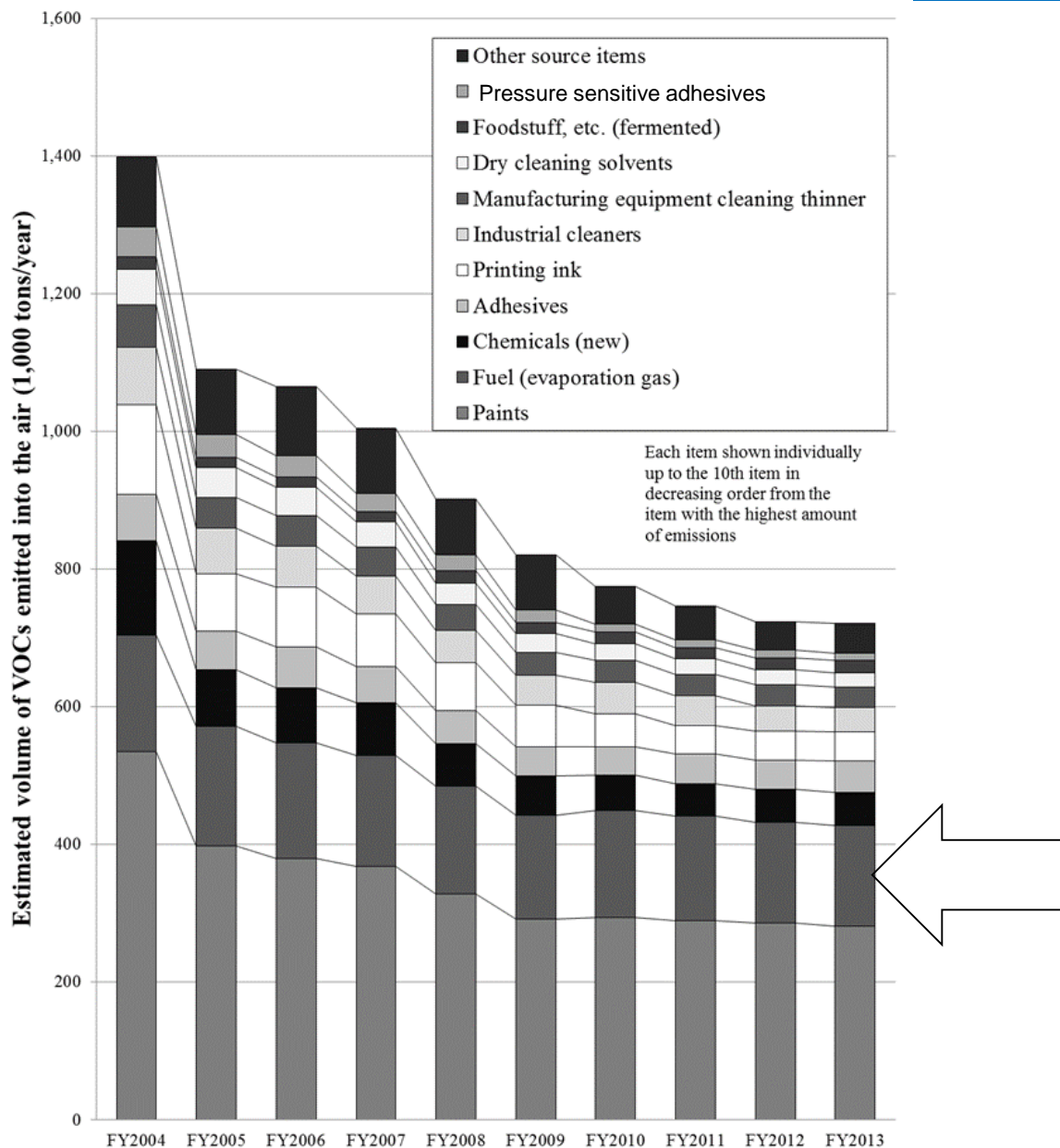
**Voluntary corporate efforts**  
(for SMEs)

Emission reduction by **best mix**

## Progress of efforts

- The emission control system started in 2005 with a goal of reducing the total VOC emissions in 2000 by 30% by 2010.
- The total VOC emissions in 2010 dropped by 44% from the 2000 level.
- Efforts to control VOC emissions will be continued.

# VOC Inventory

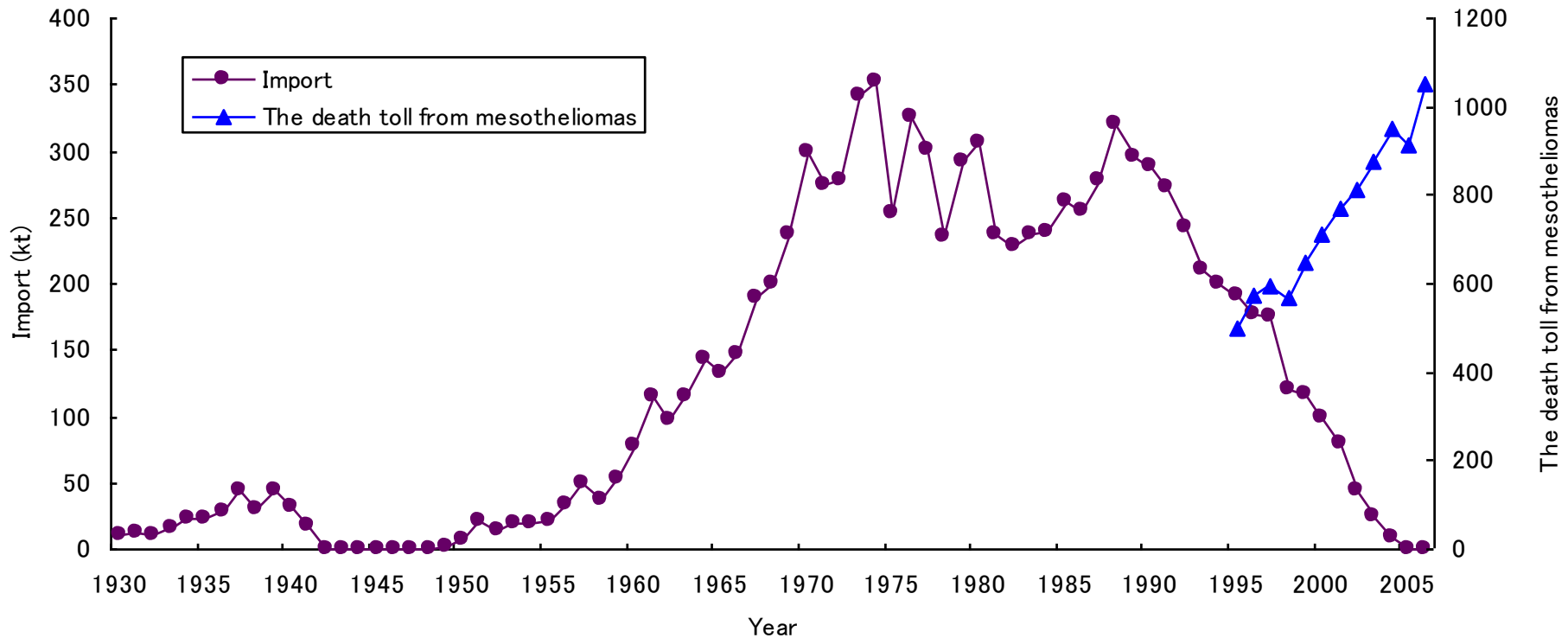


VOC emission has been decreased after starting to regulate VOC emissions from 2004

Emission of "Fuel Evaporative Gas" has not been reduced.

Certification system for the introduction of fuel dispenser was established in 2018.

# Asbestos



**Figure :** Asbestos imports and mesothelioma mortality in Japan  
(Source: Trade statistics and Population Statistics)

Asbestos had widely been used for fireproof materials in buildings. However, they were found to have strong adverse effects on human health. Their production and use were prohibited and regulation has gradually been strengthened. As many buildings will be demolished in the future, we should carefully control such activities to prevent the dispersion of asbestos.

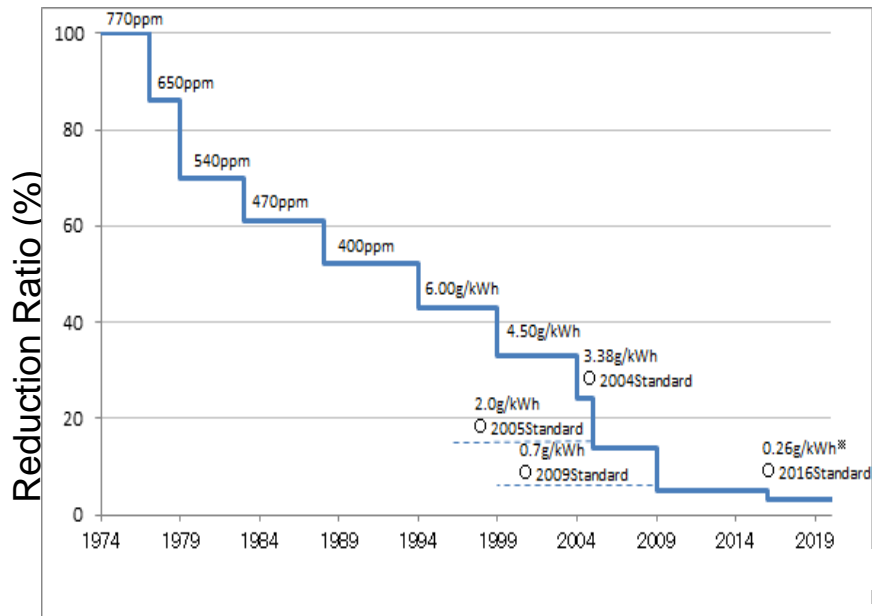


# Emission Reduction from Automobiles

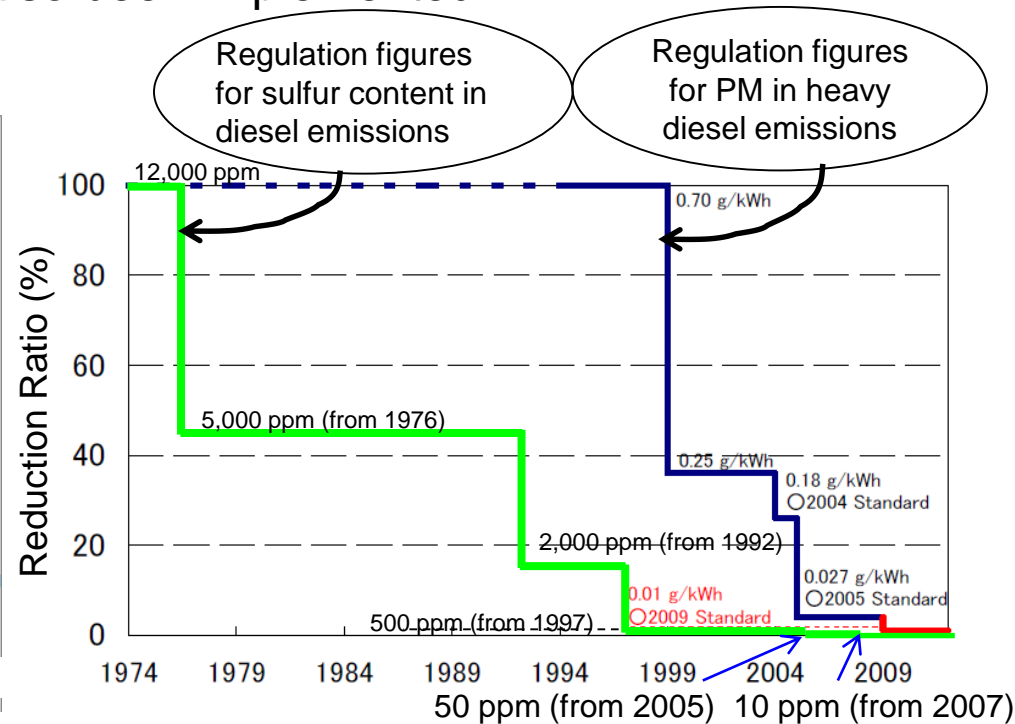
- Regulation of emissions from automobiles (unit regulation)
  - Setting permissible limits of exhaust gas emissions
  - Setting permissible limits of fuel properties
  - Setting permissible limits for off-road cars (Independent Act)
- Additional measures for polluted areas (Special Act)
  - Setting fundamental policy and action plans
  - Application of special emission standards and providing labels for used vehicles
- Promotion of low-emission vehicles
  - Green tax (economic incentive/disincentive)
  - Setting national target for spreading low-emission vehicles
- Modification of traffic conditions
  - Construction of public transportation and its improvement
  - Construction of roads and networks
- Promotion of “Eco-drive” (low emission driving methods)
- Promotion of “Environmentally Sustainable Transport (EST)”  
(See details at <http://www.uncrd.or.jp/index.php?menu=376>)

# Change in Figures of Vehicle Exhaust Gas Emissions Regulation (In case of heavy diesel vehicles)

- While taking into consideration of the progress in technological R&D for emissions reduction, stricter regulations have been phased in for improving air quality deteriorated by air pollutants
- New regulations aimed at reducing NO<sub>x</sub> emissions to 1/3 of previous levels were introduced in 2016 for heavy diesel vehicles
- A regulation for sulfur content within diesel, which affects the performance of exhaust gas processing units, has also been implemented.



Change in NO<sub>x</sub> Regulation Figures  
(Heavy Diesel Vehicles)



Change in Regulation Figures for Sulfur Content in Diesel Emissions and PM in Heavy Diesel Emissions

# Promotion of Next-generation Vehicles

## Definition

In the Low-carbon Society Action Plan (July 2008), next-generation vehicles were defined as “hybrid cars, electric cars, plug-in hybrid cars, fuel-cell cars, clean-diesel cars, CNG cars, etc.” (the same as so-called “eco-cars”).



Hybrid car



Electric car



Plug-in hybrid car



Fuel-cell car



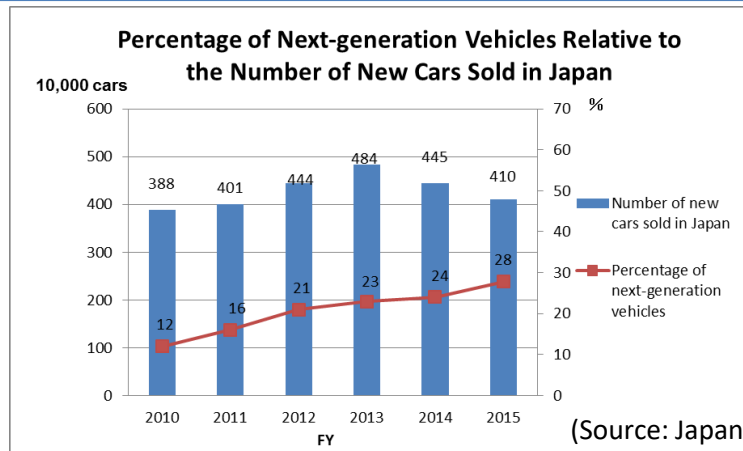
Clean-diesel car



CNG car

## Setting Target

- Goals set by the Japanese government: Increasing the percentage of next-generation vehicles relative to the number of new cars sold in Japan to 50% to 70% by 2030  
[Japan Revitalization Strategy (approved at the Cabinet meeting on June 14, 2013)]



○ The percentage of next-generation vehicles relative to the number of new cars sold in Japan has been steadily increasing, reaching 28% (quick estimation) in FY2015.

# Overview of Cooperation with Asian Countries

## Efforts by Japan, China, and Korea under the TEMM\* framework

- **Tripartite Policy Dialogue on Air Pollution (TPDAP) and its two working groups**

\*TEMM: Tripartite Environment Ministers Meeting

## Strengthening of Bilateral Collaboration

- **Inter-city Cooperation with China**

Inter-city projects have been promoted, in which local government's or industries' knowledge and know-how are used for capacity building and human resources development in the major cities in China.

- **Joint Research on PM2.5 with Korea**

Research on PM2.5 modelling and inventory has been implemented through data sharing and exchange opinions.

## Collaborative Efforts with International Organizations

- **Asia Pacific Clean Air Partnership (APCAP) collaborated with UNEP**

Establishment of joint forum and science panel, and making regional assessment report, policy brief, training manual

- **Acid Deposition Monitoring Network in East Asia (EANET)**

Started in 1998 as an intergovernmental initiative to create a common understanding on the state of acid deposition problems in East Asia, provide useful inputs for decision making at various levels to prevent and reduce the adverse impacts on the environment, and promote cooperation among countries.

- **Integrated Program on Better Quality (IBAQ) collaborated with Clean Air Asia (CAA)**

Improvement of policymaking capacity using 'The Guidance Framework for Better Air Quality in Asian Cities' (Nov. 2015) and provision of technical assistance.

# APCAP: Asia Pacific Clean Air Partnership

- Launched in 2014, Implemented by UNEP ROAP supported by Ministry of the Environment, Japan
- Establish a mechanism to coordinate and collaborate among governments and various clean air programs in the Asia Pacific
- 16 country partners in Asia Pacific participates

## 【Major activities】

- Hold the APCAP Joint forum
  - The 2nd forum was held in Bangkok in March 2018. (311 participants from 34 countries)
  - The 3rd forum will be held in Japan in October 2020.
- Establish APCAP Science Panel
  - The report summarizing the 25 measures to be preferentially implemented in the Asia Pacific region was published in October 2018.



# EANET (Acid Deposition Monitoring Network in East Asia)



## (Establishment History)

- Concerns for increasing emission of air pollutants which cause acid rain and its serious effect, stemming from recent rapid economic growth in the East Asian regions.
- Full-fledged operations since January 2001
- Appointed the Asia Center for Air Pollution Research (ACAP) in Japan as Network Center in charge of collection of monitoring data from each country and its evaluation and analysis, etc.

## (Objectives)

- To create a common understanding on acid deposition problems in East Asia
- To provide basic input on policy decision-making towards acid deposition prevention measures
- To promote international cooperation on acid deposition problems in East Asia

## (Recent activities)

- Medium Term Plan for the EANET (2016-2020) includes new activities such as promotion of the monitoring of ozone and PM2.5 and promotion of research and technical cooperation on emission inventory.

Thank you for your attention!