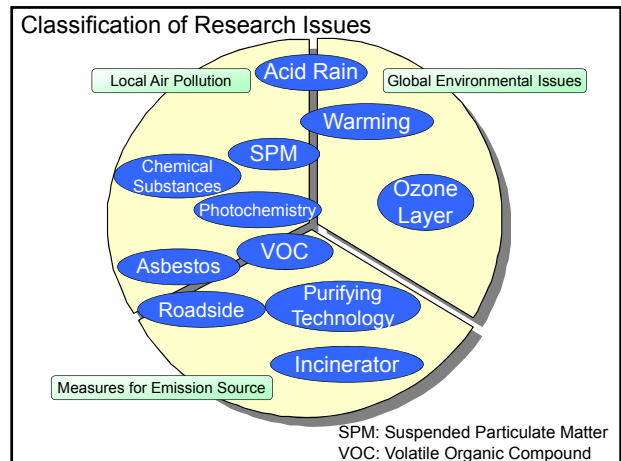# Slide 1

CESS Air Pollution Training Course
(JICA Training Course in Syria)
May 27, 2010

Air Quality in Japan

— Overview of Air Quality Measurement Methods —

**Atmospheric Environment Group
Center for Environmental Science
in Saitama (CESS)**

Slide 2

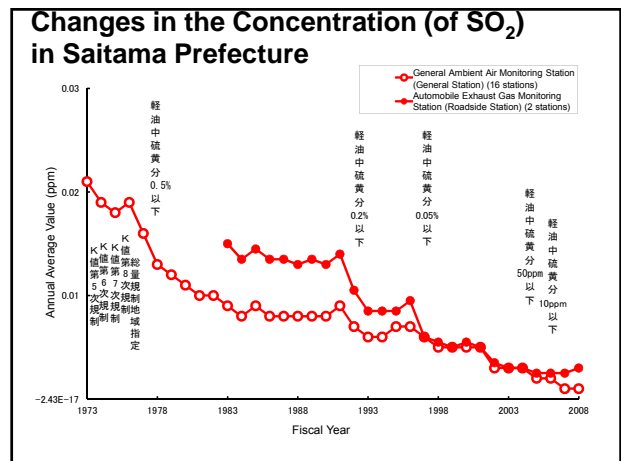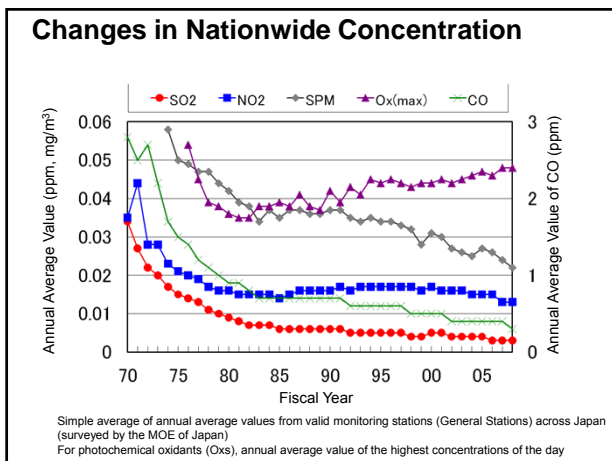## Classification of Research Issues

Local Air Pollution

Global Environmental Issues

Acid Rain

Warming

SPM

Chemical Substances

Ozone Layer

Photochemistry

VOC

Asbestos

Purifying Technology

Roadside

Incinerator

Measures for Emission Source

SPM: Suspended Particulate Matter
VOC: Volatile Organic Compound

Slide 3

Air Quality Chronology

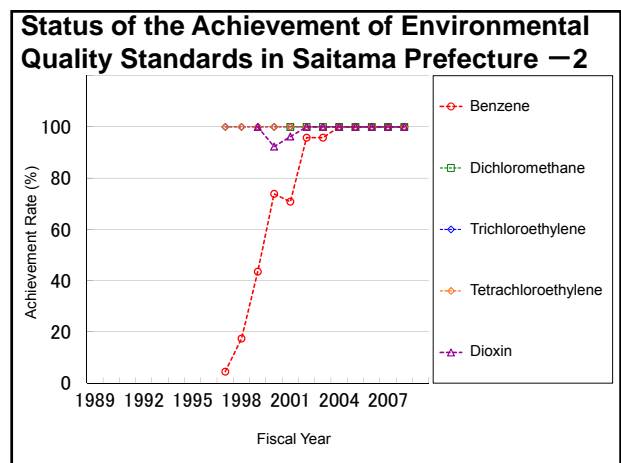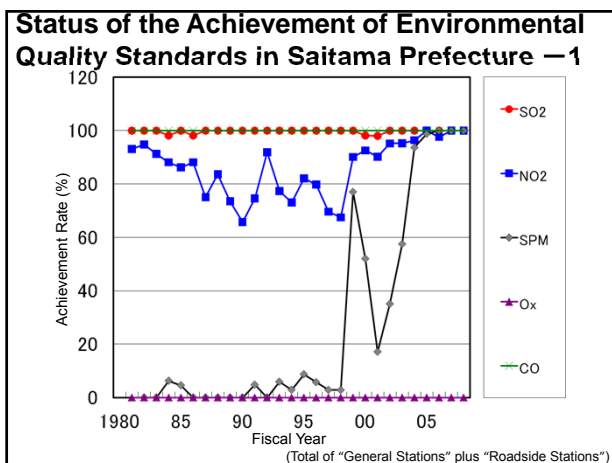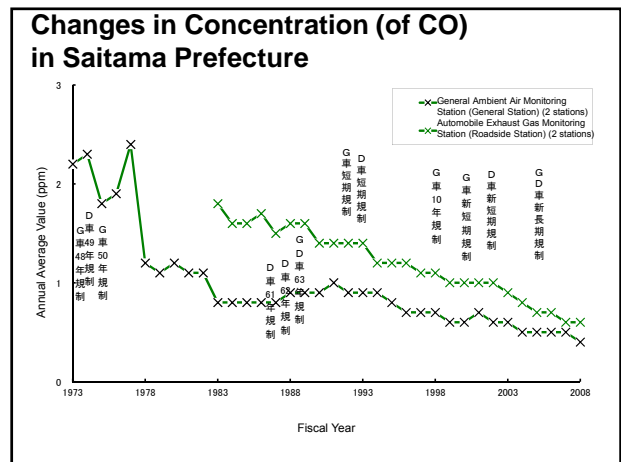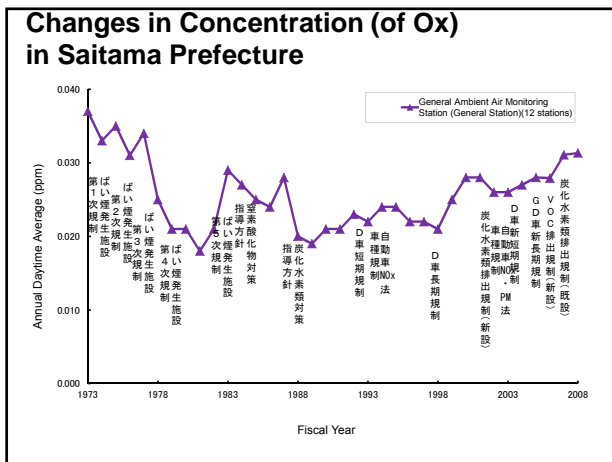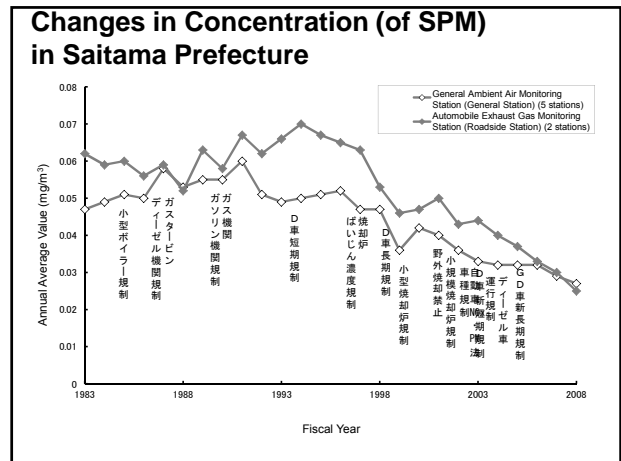| Fiscal Year	Saitama Prefecture		National
	Department Responsible for Analytical Survey	Prefectural Ordinances	Laws
1962		Prefectural Pollution Control Ordinance	★ Smoke and Soot Regulation Law
1964	Environmental Pollution Section of Environmental Health Division, Hygiene Department		
1967			☆ Basic Law for Environmental Pollution Control
1968	→ Pollution Control Office, Hygiene Department → Environmental Pollution Division, Department of Public Services		★ Air Pollution Control Law
1969		Prefectural Pollution Control Ordinance was fully revised	
1970	Saitama Institute of Environmental Pollution		
1971			Offensive Odor Control Law Law Concerning the Improvement of Pollution Prevention Systems in Specific Factories
1978		Prefectural Pollution Control Ordinance was fully revised	
1992			● Automobile NOx Law
1993			☆ Establishment of the Basic Environment Law
1994		Prefectural Basic Environment Ordinance	
1999			Law Concerning Special Measures against Dioxins
2000	Center for Environmental Science in Saitama (CESS)		
2001			● Automobile NOx/PM Law
2002		Prefectural Ordinance on the Conservation of the Living Environment	

Slide 4

Environmental Quality Standards for Air Pollution

The Environmental Quality Standards shall be as follows:

From the view of the environmental conditions related to air pollution, not only the items whose maintenance is considered preferable for the protection of human health and the conservation of the living environment, but also the standards for such items.

object substance

sulfur dioxide	SO_2
carbon monoxide	CO
suspended particulate matter	SPM
photochemical oxidants	Ox
nitrogen dioxide	NO_2
benzene	C_6H_6
trichloroethylene	C_2HCl_3
tetrachloroethylene	C_2Cl_4
methylene chloride	CH_2Cl_2
dioxin	PCDD,PCDF,DL-PCB
minute particulate matter	$PM_{2.5}$

Slide 5

Changes in Nationwide Concentration

Simple average of annual average values from valid monitoring stations (General Stations) across Japan (surveyed by the MOE of Japan)
For photochemical oxidants (Oxs), annual average value of the highest concentrations of the day

Slide 6

Changes in the Concentration (of SO_2) in Saitama Prefecture

Changes in Concentration (of NO$_2$) in Saitama Prefecture

Annual Average Value (ppm)

Legend: General Ambient Air Monitoring Station (General Station) (10 stations); Automobile Exhaust Gas Monitoring Station (Roadside Station) (6 stations)

Fiscal Year

Changes in Concentration (of SPM) in Saitama Prefecture

Annual Average Value (mg/m³)

Legend: General Ambient Air Monitoring Station (General Station) (5 stations); Automobile Exhaust Gas Monitoring Station (Roadside Station) (2 stations)

Fiscal Year

Changes in Concentration (of Ox) in Saitama Prefecture

Annual Daytime Average (ppm)

Legend: General Ambient Air Monitoring Station (General Station)(12 stations)

Fiscal Year

Changes in Concentration (of CO) in Saitama Prefecture

Annual Average Value (ppm)

Legend: General Ambient Air Monitoring Station (General Station) (2 stations); Automobile Exhaust Gas Monitoring Station (Roadside Station) (2 stations)

Fiscal Year

Status of the Achievement of Environmental Quality Standards in Saitama Prefecture －1

Achievement Rate (%)

Legend: SO2, NO2, SPM, Ox, CO

Fiscal Year

(Total of "General Stations" plus "Roadside Stations")

Status of the Achievement of Environmental Quality Standards in Saitama Prefecture －2

Achievement Rate (%)

Legend: Benzene, Dichloromethane, Trichloroethylene, Tetrachloroethylene, Dioxin

Fiscal Year

Changes in the Concentration of Dioxins in Saitama Prefecture

Environmental Quality Standard (0.6)

Prefecture's Target Value (0.3)

* Average of the quarterly-measured results for all prefectures ("in the general environment," "around stationary sources," and "along the roadside")
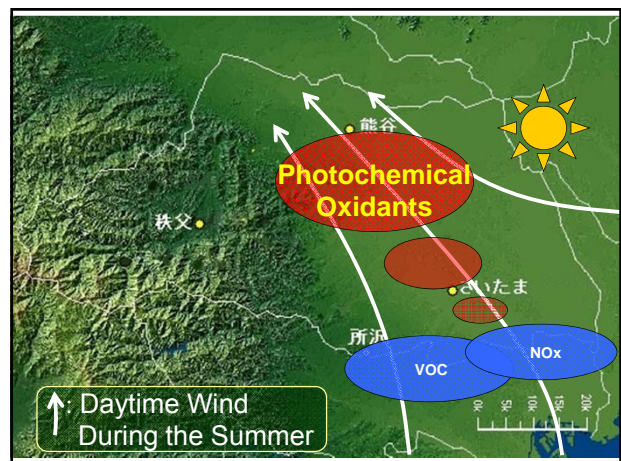
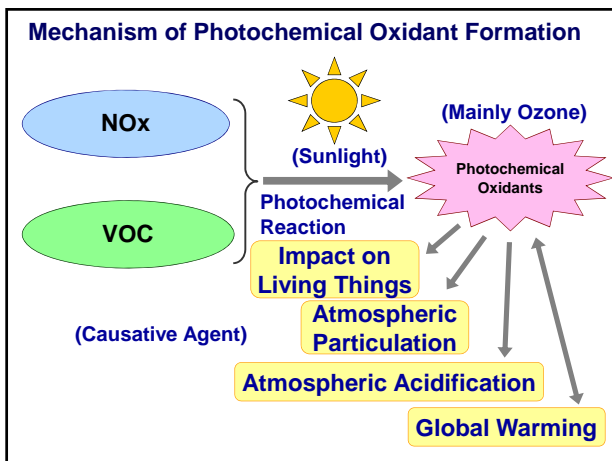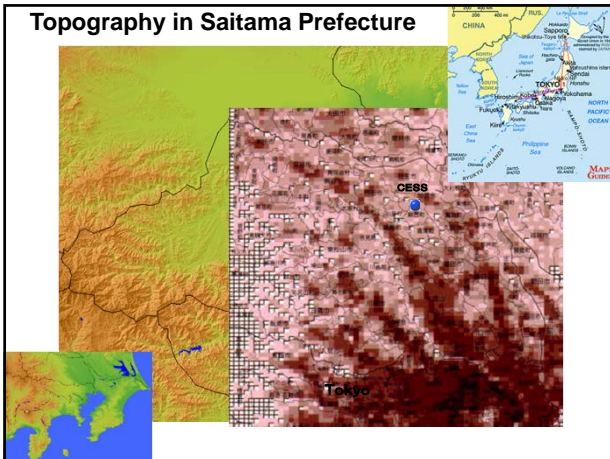# Photochemical Oxidants (Ox)
(Photochemical Smog)
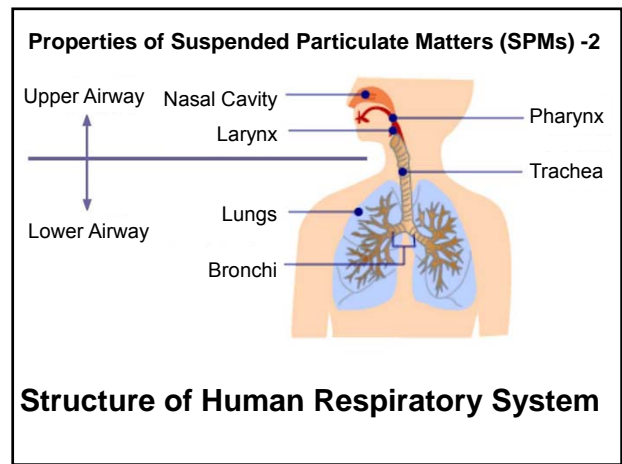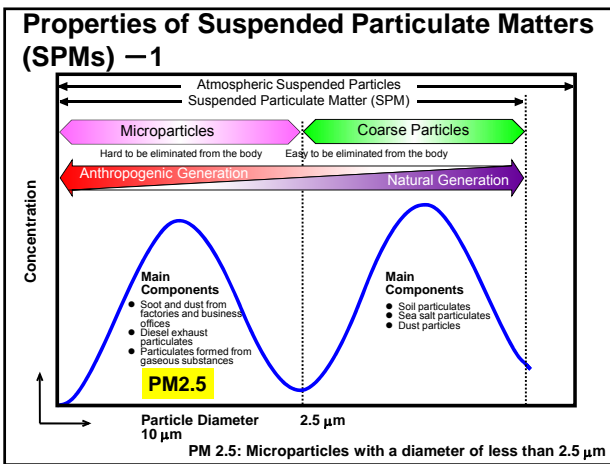
The Status of Photochemical Smog

Ranking for the Total Number of Days When A Smog Alert was Issued

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1st Place	Saitama	Saitama	Saitama	Saitama	Chiba	Chiba	Tokyo	Saitama	Tokyo	Saitama
2nd Place	Ibaraki	Chiba	Chiba	Ibaraki	Saitama	Saitama	Osaka	Kanagawa	Saitama	Osaka
3rd Place	Tokyo	Tokyo	Tokyo	Osaka	Tokyo	Tokyo	Saitama	Chiba	Chiba	Aichi
4th Place	Osaka	Osaka	Gunma	Chiba	Ibaraki	Tochigi	Kanagawa	Tokyo	Gunma	Tochigi Tokyo
5th Place	Tochigi	Tochigi	Ibaraki	Tochigi	Kanagawa	Ibaraki	Yamanashi	Tochigi	Kanagawa	

Mechanism of Photochemical Oxidant Formation

Topography in Saitama Prefecture

PM 2.5

Properties of Suspended Particulate Matters (SPMs) −1

Atmospheric Suspended Particles
Suspended Particulate Matter (SPM)

Microparticles

Coarse Particles

Hard to be eliminated from the body

Easy to be eliminated from the body

Anthropogenic Generation

Natural Generation

Concentration

Main Components
- Soot and dust from factories and business offices
- Diesel exhaust particulates
- Particulates formed from gaseous substances

PM2.5

Main Components
- Soil particulates
- Sea salt particulates
- Dust particles

Particle Diameter
10 μm

2.5 μm

PM 2.5: Microparticles with a diameter of less than 2.5 μm

Properties of Suspended Particulate Matters (SPMs) -2

Upper Airway

Nasal Cavity

Pharynx

Larynx

Trachea

Lower Airway

Lungs

Bronchi

Structure of Human Respiratory System

Changes in Concentration (of PM2.5) in Saitama Prefecture

PM2.5 - mass concentration (μg/m³)

2009/Apr 2009/May 2009/Jun 2009/Jul 2009/Aug 2009/Aug 2009/Sep 2009/Oct 2009/Nov 2009/Dec 2010/Jan 2010/Feb 2010/Mar

VOC

VOCs are the Causative Agents of Photochemical Oxidants and PM 2.5

Photochemical Oxidant

Ozone (O_3)

VOC SO_x NO_x

Suspended Particulate Matter
SPM Secondary Particle

Primary Particle

Natural Sources Anthropogenic Sources

(MOE's Pamphlet)

VOC Emission Control

VOC Emission Control (Air Pollution Control Law)

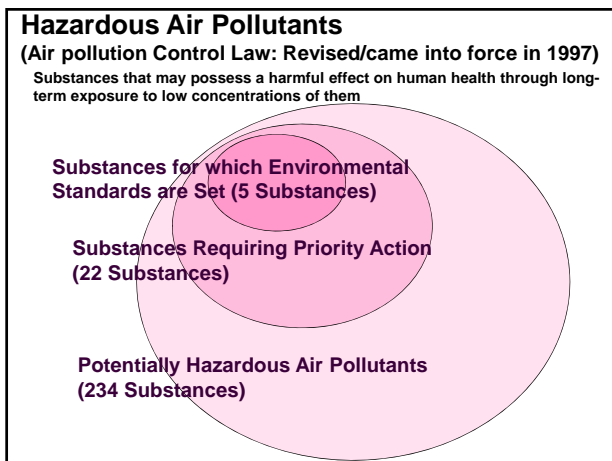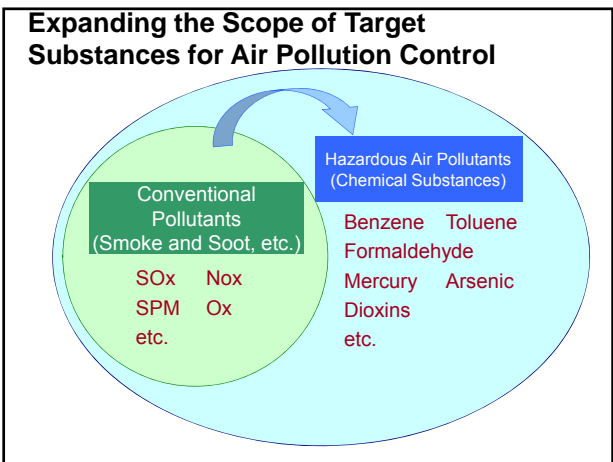Voluntary Efforts to Control VOC Emissions (Air Pollution Control Law)

➡ Exhaust Emissions Survey of the Facilities Covered by Relevant Regulations

Regulations on Facilities Emitting VOCs (Prefectural Ordinance on the Conservation of the Living Environment)

VOC Measurement and Technical Advice for VOC Emission Control

➡ VOC Survey to Support VOC Emission Reduction

Hazardous Air Pollutants

Expanding the Scope of Target Substances for Air Pollution Control

Hazardous Air Pollutants (Chemical Substances)

Conventional Pollutants (Smoke and Soot, etc.)

SOx Nox
SPM Ox
etc.

Benzene Toluene
Formaldehyde
Mercury Arsenic
Dioxins
etc.

Hazardous Air Pollutants

(Air pollution Control Law: Revised/came into force in 1997)

Substances that may possess a harmful effect on human health through long-term exposure to low concentrations of them

Substances for which Environmental Standards are Set (5 Substances)

Substances Requiring Priority Action (22 Substances)

Potentially Hazardous Air Pollutants (234 Substances)
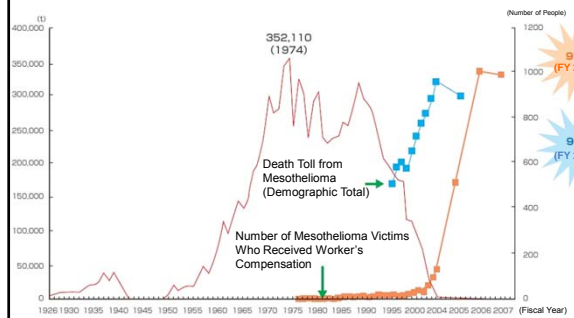

Asbestos

What is Asbestos?

- A General Term for Natural Fibrous Minerals
  - **Definition by ILO (International Labor Organization)**
    Fibrous inorganic silicates belonging to the serpentine group or amphibole group, both of which are minerals derived from rock
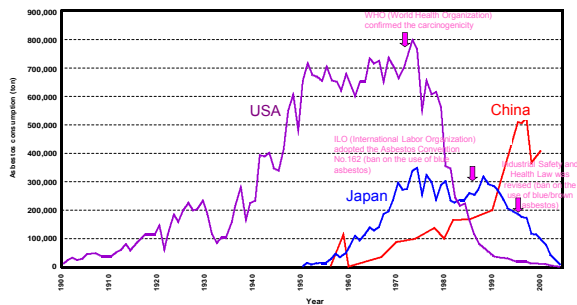- **The following three types of asbestos were practically used:**

	Toxicity
Chrisotile (White Asbestos) Chrisotile	1
Amosite (Brown Asbestos) Amosite	100
Crocidolite (Blue Asbestos) Crocidolite	500

Asbestos Import and Trends in the Incidence of Mesothelioma

352,110 (1974)

995 (FY 2007)

911 (FY 2005)

Death Toll from Mesothelioma (Demographic Total)

Number of Mesothelioma Victims Who Received Worker's Compensation

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Changes in Asbestos Consumption in Different Countries

Changes in Asbestos Consumption in the U.S., Japan, and China
(U.S. Geol. Serv Minerals Yearbook, and Japanese Custom Statistics)

Offensive Odor

Odor Nuisance

Regulations Concerning the Concentration of Specified Offensive Odor Components (22 Substances)

Ammonia, methyl mercaptan, hydrogen sulphide, methyl sulphide, methyl disulphide, trimethylamine, acetaldehyde, propionaldehyde, n-butylaldehyde, isobutylaldehyde, n-valeraldehyde, isovaleraldehyde, isobutanol, ethyl acetate, methyl isobutyl ketone, toluene, xylene, propionic acid, n-butyric acid, n-valeric acid, and isovaleric acid

Odor Index Regulation — Triangular Odor Bag Method

Triangular Odor Bag Method ー 1

Triangular Odor Bag Method － 2

Triangular Odor Bag Method － 3

System for Offensive Odor Control

Discharge Outlet

Site Boundary

Discharged Water