Air Quality of Tokyo

Representative pollutants, which contaminate the atmosphere and present a danger to public health, include nitrogen dioxide, SPM, photochemical oxidant, sulfur dioxide, carbon monoxide, and Fine Particulate Matter. For these substances, environmental quality standards (reference \( P80 \)) have been established as administrative targets. In order to improve air pollution and to protect the health of Tokyo residents, TMG has been making efforts to achieve environmental quality standards for these substances.

TMG is monitoring the status of air pollution for 24 hours a day, 7 days a week, at air pollution-monitoring stations installed in various places in the Tokyo area (reference \( P80 \)). As for achievement ratios in FY2010, emissions of nitrogen dioxide met environmental quality standards at all 43 ambient air monitoring stations and at 32 of 35 roadside air pollution monitoring stations. As for SPM, concentrations achieved environmental quality standards at all ambient air monitoring stations and all roadside air pollution monitoring stations.

Regarding the annual average concentration of these substances, emissions of nitrogen dioxide indicate a gradual reduction trend. As for SPM emissions, they have been either unchanged or on a decreasing trend, and the differences in value between ambient air monitoring stations and roadside air pollution monitoring stations have been shortened. Emissions of carbon monoxide and sulfur dioxide met environmental quality standards at all monitoring stations, while emissions of photochemical oxidant do not clear environmental quality standards at all of the monitoring stations.

Air Pollution Control

For the 10 years following 1965, Tokyo’s air was polluted mainly by soot and smoke from factories. Air pollution has been drastically improved by taking countermeasures against stationary sources, such as strict control of air pollutant sources, including boilers and use of higher-quality fuel. Subsequently, due to an increase in automobile traffic and exhaust gas from diesel vehicles being major causes of air pollution, achievement ratios of environmental quality standards for nitrogen dioxide and Suspended Particulate Matter (SPM) emissions have been constantly low. Therefore, in October 2003, ahead of the national government, TMG enforced a diesel vehicle emission control. As a result, SPM emissions achieved environmental quality standards at all air pollution-monitoring stations, steadily improving the air environment in Tokyo.

However, some issues remain, such as measures against photochemical oxidant and air pollution in the coastal area of the Port of Tokyo.

In order to realize the cleanest urban environment among the world’s largest cities, TMG will strengthen measures against these issues, as well as tackling other issues, including Fine Particulate Matter (PM0.1), etc. Additionally, TMG will also promote measures to relieve the concerns of Tokyo residents including thorough implementation of preventative measures against airborne asbestos in the demolition work of buildings.
Measures against Air Pollution by Vehicle Exhaust

Automobiles play a major role in urban traffic and have contributed to making our lives more convenient. However, in exchange for this convenience, they are causing air pollution.

Due to loose national emission limits on old diesel vehicles, which have resulted in preventing the popularization of new diesel vehicles meeting stricter limits and generating chronic traffic congestion, air pollution from automobiles has not improved at all and countermeasures have been lagging for a long time.

Given these factors, TMG has been working on the improvement of air pollution and steadily making achievements by developing measures against environmental pollution from automobiles including: implementing regulations for operations of old diesel vehicles based on the Tokyo Metropolitan Environmental Security Ordinance; promoting the popularization of low-emission vehicles; and promoting transportation demand management (TDM).

Importance of Measures against Diesel Vehicle Exhaust

Looking at emissions of nitrogen oxide (NOx) and particulate matter (PM) in Tokyo, approximately 50% of NOx and approximately 30% of PM are emissions from automobiles. Of the emissions from automobiles, approximately 80% of nitrogen oxide and almost all PM are from diesel vehicles.

The PM inherent in exhaust gas from diesel vehicles is known to be carcinogenic and is related to respiratory diseases and pollen allergies. To protect the health of Tokyo residents, measures against exhaust gas from diesel vehicles play an important role.

Regulation on Diesel Vehicle Emission

In accordance with the Tokyo Metropolitan Environmental Security Ordinance, TMG enforced regulations on diesel vehicle emissions in October 2003.

Regulated diesel vehicles include diesel vehicles that do not satisfy the nation’s new short-term regulation (by March 2006, the nation’s long-term regulation applies) of buses, trucks, and special automobiles including concrete mixer vehicles, sanitation vehicles, and refrigerator and freezer vehicles (excluding passenger vehicles).

Since the enforcement of the regulations, diesel vehicles that do not satisfy PM emissions standards designated by the ordinance cannot be driven in Tokyo. However, for vehicles first-registered in the last 7 years, application of the regulations will be waived. Vehicles failing to meet the standards are required to be replaced by vehicles satisfying the latest regulations or low-emission vehicles or to install PM reduction equipment designated by the Governor of Tokyo.

Additionally, similar regulations are being enforced in neighboring Saitama, Chiba, and Kanagawa Prefectures. After the enforcement of regulations in 2003, PM emission standards designated by the ordinance employed the same values used for former long-term emission regulations applied for new cars by the country. However, since April 1st, 2006, Saitama Prefecture and TMG have imposed stricter limits, the same values as the new short-term country regulations.

Regulating Illegal Diesel Vehicles

To secure the effectiveness of various regulations related to automobiles, in accordance with the Tokyo Metropolitan Environmental Security Ordinance, TMG assigned Tokyo vehicle pollution regulators (also known as illegal diesel vehicle regulators), regulating vehicles failing to meet the standards. Contents of the regulatory actions by the regulators include vehicle inspections on the street and at distribution centers and regulating illegal vehicles by recording vehicles with video cameras. Additionally, from June 2004, by utilizing fixed cameras installed on the Metropolitan Expressway, measures against vehicles entering Tokyo from other prefectures have been strengthened.

Furthermore, TMG opened a stop the diesel black smoke (dry scoot) hotline so that Tokyo residents can report illegal diesel vehicles.

From the enforcement of the regulations to the end of March 2011, regulatory actions were taken at a total of 130 locations on the street and at distribution centers (including truck terminals, and piers). Additionally, inspections recorded with video cameras were conducted at a total of 791 locations. (URL) http://www.kanyou.metro.tokyo.jp/vehicle/air_pollution/diesel/regulation/g_new.html

Where it has been confirmed that a noncompliant vehicle has been driven within Tokyo, prompt compliance with the applicable regulations will be urged, and the person responsible for operation of the vehicle will be banned from driving in Tokyo as his or her administration penalty for noncompliance.

If the person banned from driving fails to comply with this order, he or she will be subject to punishment involving the public disclosure of his or her identity as an offender and a fine of up to 500,000 yen.

Emissions of Nitrogen Oxide (NOx) and Particulate Matter (PM) in Tokyo

<table>
<thead>
<tr>
<th>FY2000</th>
<th>FY2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx emissions in Tokyo</td>
<td>NOx emissions in Tokyo</td>
</tr>
<tr>
<td>73,700 ton/year</td>
<td>56,130 ton/year</td>
</tr>
<tr>
<td>Diesel vehicles: 44%</td>
<td>Diesel vehicles: 36%</td>
</tr>
<tr>
<td>Gasoline and LPG vehicles: 28%</td>
<td>Gasoline and LPG vehicles: 41%</td>
</tr>
<tr>
<td>Vessels and airplanes: 1%</td>
<td>Vessels and airplanes: 3%</td>
</tr>
<tr>
<td>Construction machinery: 19%</td>
<td>Construction machinery: 17%</td>
</tr>
</tbody>
</table>

PM emissions in Tokyo

<table>
<thead>
<tr>
<th>FY2000</th>
<th>FY2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,150 ton/year</td>
<td>3,920 ton/year</td>
</tr>
<tr>
<td>Diesel vehicles: 56%</td>
<td>Diesel vehicles: 26%</td>
</tr>
<tr>
<td>Gasoline and LPG vehicles: 26%</td>
<td>Gasoline and LPG vehicles: 9%</td>
</tr>
<tr>
<td>Vessels and airplanes: 2%</td>
<td>Vessels and airplanes: 1%</td>
</tr>
<tr>
<td>Construction machinery: 11%</td>
<td>Construction machinery: 11%</td>
</tr>
</tbody>
</table>

Air Pollution Control

Air from tires and braking: 12%

1. Automobile emissions do not include effects by starting vehicles.
2. Emissions from factories include condensed dust (PM).
3. Automobile emissions do not include PM emitted from the ground to the atmosphere by driving automobiles.
4. Secondary generated PM is not included.
5. Since the values for each item are rounded off, there might be a rounding error for the total amount.
In June 2001, TMG established the Tokyo Metropolitan guideline for designating equipment that reduces Suspended Particulate Matter (SPM). Based on the guideline, TMG conducts screening of PM reduction equipment applied for designation at a review board consisting of experts to provide the designation. Furthermore, from June 2002, as a common system of 9 local governments’ coalition in the Kanto District, TMG provides designations for PM reduction equipment.

As of the end of March 2011, designated PM reduction equipment includes 36 types of diesel particulate filters (DPF) from 21 suppliers and 33 types of oxidation catalysts from 13 suppliers. Vehicles with PM reduction equipment are expected to carry certificates issued by manufacturers and affix stickers to the vehicles.

**Effects of Diesel Vehicle Regulations in Air Pollution Improvement**

Environmental standards for SPM have been achieved in Tokyo for 6 consecutive years at all roadside air pollution monitoring stations.

**Effects of Diesel Vehicle Regulations**

The air environment in Tokyo regarding SPM emissions has drastically improved. This can be considered to be the result of diesel vehicle regulations enforced by 9 local governments’ coalition since October 2003. According to the measurement results of the atmosphere in FY2010, for 6 consecutive years since FY2005, SPM emissions achieved environmental standards at all roadside air pollution monitoring stations.

**Achievement Ratio of Environmental Standards for SPM Emissions**

| Year | SPM Emissions
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>11.8%</td>
</tr>
<tr>
<td>2002</td>
<td>0%</td>
</tr>
<tr>
<td>2003</td>
<td>0%</td>
</tr>
<tr>
<td>2004</td>
<td>0%</td>
</tr>
<tr>
<td>2005</td>
<td>0%</td>
</tr>
<tr>
<td>2006</td>
<td>0%</td>
</tr>
<tr>
<td>2007</td>
<td>0%</td>
</tr>
<tr>
<td>2008</td>
<td>0%</td>
</tr>
<tr>
<td>2009</td>
<td>0%</td>
</tr>
<tr>
<td>2010</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Support Systems Related to Diesel**

Vehicle regulations: To assist small and medium-sized enterprises to comply with regulations of the ordinance despite their challenging business environment, TMG provides support systems to provide a subsidy for the installation of PM reduction equipment as well as mediations for loans. (Please also refer to P25.)

**Future Measures**

Aiming for the early achievement of environmental standards for nitrogen dioxide (NOx) emissions, TMG will continue to promote its measures against automobile emissions including providing stickers for vehicles with lower environmental loads and measures to improve local heavy pollution, and will strengthen measures to reduce GHG emissions.

**Local Heavy Pollution**

At the roadside of main roads in Tokyo, air pollution by nitrogen oxide (NOx) and SPM is generated. In areas with layered road structures, pollutants tend to stay without being dispersed, resulting in locally high concentrations of pollutants in these areas.

To solve this problem, at intersections in Yamato-cho, Itabashi Ward, the Ministry of Land, Infrastructure, Transport and Tourism, Metropolitan Expressway Co., Ltd., and TMG are conducting various measures including the creation of an open space at the corner of the intersection to promote dispersion of the atmosphere and the operation of experimental facilities to purify the atmosphere by utilizing soil. Additionally, at an intersection of Matsubara-bashi, Ota Ward, the Ministry of Land, Infrastructure, Transport and Tourism and TMG installed experimental facilities to purify the atmosphere by utilizing soil to improve the environment.

**Measures against NOx Emissions from Automobiles**

In Tokyo, as a result of regulating diesel vehicle emission and the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas, the shift to the vehicles with lower environmental loads has progressed and particulate matter (PM) emissions have been reduced, achieving environmental standards at all air pollution-monitoring stations. On another front, the achievement ratio of environmental standards for nitrogen dioxide (NOx) emissions is nearly 90%. One of the reasons is that old vehicles, which cannot be registered in the specified areas covered by the Law, are permitted for continued possession outside the areas and these vehicles continue to be driven into Tokyo.

For this reason, TMG revised the Tokyo Metropolitan Environmental Security Ordinance and newly enforced an obligation for cargo owners and travel agents in Tokyo to prevent the usage of vehicles with large environmental loads. From April 2009, TMG is promoting these measures to prevent the use of vehicles with large environmental loads.

Based on this, when using automobiles for TMG’s businesses, to promote the measures to prevent the use of vehicles with large environmental loads, TMG is taking the initiative in starting measures to direct the use of vehicles with lower environmental loads to counterparts.

For instance, by utilizing a labeling system on buses, as described in the right-hand section of this page, TMG has just started a measure not to use buses that do not satisfy a certain level of environmental performance. Additionally, TMG is encouraging business associations to follow suit so that similar measures will be taken by companies.

**Environmental Labeling for Sightseeing Buses**

TMG is working on the environmental labeling of sightseeing buses in cooperation with bus and traveling industry organizations so that participants of bus tours in Japan can use eco-friendly buses.

Environmental labeling of sightseeing buses (indication of environmental performance) includes the evaluation of buses used for domestic tours for their eco-friendliness (exhaust gas emission levels) and indication of the assessment results (graded between AAA and B) on car bodies of the buses or tour brochures.

The environmental label shown on the right-hand side will be indicated around the entrance of and on the rear window of the bus.

Air Pollution Control

Measures against Emission Sources

As for substances with designated emissions standards such as soot and smoke, TMG is guiding these facilities to submit Initial Notification of Applicability, examining these notifications on the law. If necessary, TMG also conducts on-the-spot inspections.

Additionally, TMG also conducts Research on industrial smoke emissions every year, and inspects all soot- and smoke-emitting facilities in Tokyo (excluding those for emergency use) in order to confirm their compliance status. Furthermore, TMG estimates total emissions of nitrogen oxide (NOx), sulfur oxide (SOx), and soot and dust in Tokyo.

In addition, in order to improve air pollution in the coastal areas of the Port of Tokyo, TMG is promoting measures against emitted gas from vessels on the berth.

✔ Support for Voluntary Measures for Facilities

In addition to traditional regulations and administrative guidance by TMG, facilities are voluntarily advancing their own measures. One example is measures against VOCs (Volatile Organic Compounds), a causative substance of photochemical oxidant.

TMG is promoting various measures to support these facilities and their organizations handling VOCs in order to contribute to reduction in emissions.

✔ Measures against Small-Sized Boilers and Gas Heat Pumps

Business-use small-sized combustion appliances that are smaller than those subject to the regulations in law, including boilers, water cooling and heating machines, gas heat pumps, emitted nitrogen oxide into the air, accounting for about 20% of total nitrogen oxide emissions from stationary sources in Tokyo. Estimates also show that the CO2 emissions of these appliances constitute about 8% of total CO2 emissions.

In relation to these appliances, TMG established standards for energy-saving performance in addition to traditional standards for nitrogen oxide in March 2009 and began to certify those appliances which meet the standards as a "low-NOx and highly efficient small-sized boiler and gas heat pump". In FY2010, 50 different appliances were certified, bringing the total number of the certified appliances to 233. If currently existing small-sized combustion appliances are all updated to meet the standards, 500,000 tons of CO2 can be reduced annually according to estimates.

Certified appliances bear labels as shown below.

Promotion of Measures against Fine Particulate Matter 2.5 (PM2.5) in the Atmosphere

Since PM2.5 with a particle diameter of less than 2.5 μm (micrometer: 1 μm is one-thousandth of 1 mm) can reach all the way to the bronchi and the lungs through the windpipe, the serious effects on health is a concern. Given this factor, in September 2009, the national government established environmental standards for PM2.5, with the “annual average value to be below 15 μg/m³ and the daily average value to be below 35 μg/m³.”

TMG is conducting a survey study on measurements of chemical concentration and components in the air, their sources, production mechanism, etc.

Transition of NOx emissions from a research on industrial smoke emissions

<table>
<thead>
<tr>
<th>Year</th>
<th>FY2005</th>
<th>FY2006</th>
<th>FY2007</th>
<th>FY2008</th>
<th>FY2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>8,930</td>
<td>8,758</td>
<td>8,854</td>
<td>7,914</td>
<td>7,503</td>
</tr>
<tr>
<td>0</td>
<td>2,163</td>
<td>2,143</td>
<td>2,043</td>
<td>1,730</td>
<td>1,584</td>
</tr>
<tr>
<td>1,971</td>
<td>1,824</td>
<td>1,686</td>
<td>1,584</td>
<td>4,976</td>
<td>4,562</td>
</tr>
<tr>
<td>4,796</td>
<td>4,987</td>
<td>4,499</td>
<td>4,065</td>
<td>4,065</td>
<td>4,065</td>
</tr>
</tbody>
</table>
Measures against Asbestos

TMG has been taking measures against asbestos ahead of the national government, establishing its own basic policy in 1987. Additionally in 1994, to prevent airborne asbestos during the demolition work of buildings, TMG stipulated matters that require attention in the demolition of buildings in the Tokyo Metropolitan Pollution Prevention Ordinance (currently the Tokyo Metropolitan Environmental Security Ordinance), before establishment of the law by the government. TMG is currently continuing its efforts in coalition with the national government and municipalities for preventative measures against airborne asbestos during the demolition work of buildings.

As for asbestos mould (those other than airborne building materials), though there is less risk of scattering on a daily basis, the actual conditions of scattering in demolition and its preventative measures are not widely well known. TMG has made a manual for dealing with asbestos during demolition work so that enterprises take the countermeasures.

Measures to Reduce VOCs Emissions Causing Photochemical Smog

As a result of implementing air pollutant regulation for factories and diesel vehicle emissions, the concentration levels of many air pollutants have been on a decreasing trend. However, we have not been able to meet the environmental standards regarding photochemical oxidant (Ox) yet and the number of days when greater concentration of Ox is observed still remains high.

Photochemical oxidant is generated by the chemical reaction of nitrogen oxide (NOx) and VOCs under sunlight (ultraviolet rays). A high concentration of Ox can have negative impacts on humans and plants.

VOCs, causative substances and the collective term for organic compounds, can easily evaporate and become gases in the atmosphere. Representative VOCs substances are toluene, xylene, and ethyl acetate. There are approximately 200 kinds of major VOCs. Though emissions of VOCs and NOx as causative substances of Ox are on a decreasing trend, the Ox level is on an increasing trend. The reason of this increasing trend is considered that the reduction of VOCs is not sufficient as compared with NOx. Therefore, the reduction of VOC emissions is more important problem than ever.

Since VOCs are also causative substances generating SPM and include substances hazardous to the human body, it is necessary to reduce their usage to an appropriate level in order to reduce environmental risk.

Generation of Photochemical Oxidant (Image)

VOCs are included in coating materials, adhesive materials, and inks as solvent. In addition, they are used in various fields such as cleaning of metal parts and dry-cleaning. Furthermore, they are generated from automobiles, boilers, household utensils and office equipments as well as from the natural world, such as plants.

Measures to Reduce Emissions

Aiming to reduce VOCs emissions from factories, the Air Pollution Control Law was partially revised in May 2004. A new system, called “Best Mix”, has started to effectively reduce the emissions by combining emission regulations for large-scale offices and voluntary emission suppression measures by companies.

Analyzing VOCs emissions in Tokyo, VOCs from stationary evaporation sources, such as painting, printing, cleaning, and metallic finishing account for approximately 65% of total emissions and are mainly generated from small and medium-sized companies. In order to support their voluntary efforts, TMG is promoting technological support, such as holding seminars for small and medium-sized companies, distributing technological guides for effective VOCs emission suppression, and dispatching advisors to provide counseling on suppression measures in accordance with the actual situations.

For outdoor painting that cannot be suppressed by the installation of VOCs-processing equipment, it is important to obtain understanding so that products with lower VOCs emissions are used when these products are installed by ordering parties.

Furthermore, the 2009 survey revealed that VOCs were emitted from general consumer goods used in households and offices in relatively higher concentration.

TMG is encouraging the preferential use of low-VOCs-emission paint, as defined in the Tokyo Metropolitan Green Purchase Guideline and the Tokyo Metropolitan green procurement principle (public construction), and is introducing case studies on the website. Through these PR activities, TMG is improving the awareness of both residents and companies.

Breakdown of Total VOC Emissions