Future Policy for
Motor Vehicle Emission Reduction
(Eighth Report)

April 8, 2005

Central Environment Council

Chukanshin No. 249
April 8, 2005

To: Her Excellency Yuriko Koike
Minister of the Environment

From: Motoyuki Suzuki
Chairperson
Central Environment Council

Subject: "Future Policy for Motor Vehicle Emission Reduction (Eighth Report)"

In response to an inquiry concerning "Future Policies for Motor Vehicle Emission Reduction" (Inquiry No. 31, dated May 21, 1996), the Central Environment Council (Chukanshin), having studied and deliberated the issues, submits the following recommendations based on its conclusions.

Future Policy for Motor Vehicle Emission Reduction
(Eighth Report)

In response to an inquiry concerning "Future Policy for Motor Vehicle Emission Reduction" (Inquiry No. 31, dated May 21, 1996), seven reports have been compiled and submitted to date: The Interim Report submitted in October 1996 was followed by the Second Report (November 1997), Third Report (December 1998), Fourth Report (November 2000), Fifth Report (April 2002), Sixth Report (June 2003), and Seventh Report (July 2003). Of these reports, the Second Report to the Fifth Report established target levels representing two phases of emissions reductions—the "new short-term targets" and "new long-term targets"—for motor vehicles powered by gasoline or liquefied petroleum gas (hereinafter referred to as gasoline/LPG motor vehicles) as well as for those using diesel fuel (hereinafter referred to as diesel motor vehicles).

The new long-term targets for diesel motor vehicles in particular are among the world's most rigorous, calling for a 75% to 85% reduction in emissions of particulate matter (hereinafter referred to as "PM") and a 41% to 50% reduction in nitrogen oxides (hereinafter referred to as "NOx") from the corresponding new short-term targets by 2005. However, in order to ensure that environmental quality standards are largely attained by fiscal year 2010 and maintained in subsequent years, a further tightening of permissible limit target levels is necessary. In October 2003, the Experts Committee on Motor Vehicle Emissions of the Central Environment Council therefore started examining further measures to reduce motor vehicle emissions beyond the new long-term targets for diesel vehicles based on the premise that mainly exhaust after-treatment devices for NOx will be utilized, assuming that the sulfur content in diesel fuel will be reduced to 10 ppm or less in line with the Seventh Report.

The attached Eighth Report of the Experts Committee on Motor Vehicle Emissions was compiled by said committee on the basis of a comprehensive study of policies for reducing motor vehicle emissions. After receiving said Eighth Report and deliberating its content, the Air Environment Committee concluded that the effective promotion of motor vehicle emissions reduction would be best served by adopting the report and, in keeping with its content, recommending that new permissible limit target levels be established for diesel motor vehicles and gasoline/LPG motor vehicles.

Accordingly, the Central Environment Council submits the following recommendations.

1. Measures to Reduce Emissions from Diesel Motor Vehicles

1.1 Motor Vehicle Emission Reduction Technologies

In order to dramatically reduce PM and NOx emitted from diesel motor vehicles, because there are limits to what can be achieved solely by improving technologies to reduce emissions from engines, the introduction of exhaust after-treatment devices is essential.

Among exhaust after-treatment devices, as catalyst systems which reduce NOx (hereinafter referred to as "NOx reduction catalysts"), catalyst systems which adsorb or absorb NOx into catalysts where they are reduced (hereinafter referred to as "NOx adsorber catalysts") and a catalyst system which adds urea to reduce NOx (hereinafter referred to as "Urea SCR") are being introduced in phases, and the judgment was made that the purifying performance and durability of such NOx reduction catalysts will be promoted with the increasingly widespread use of diesel fuel with a sulfur content of 10 ppm or less.

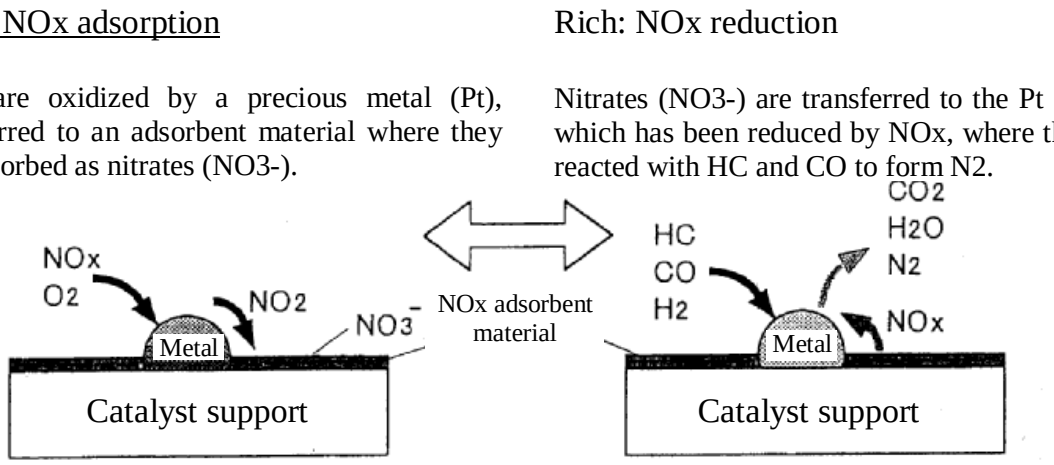

Fig. 1 Example of a NOx Adsorber Catalyst (Source: Toyota Motor Corporation)

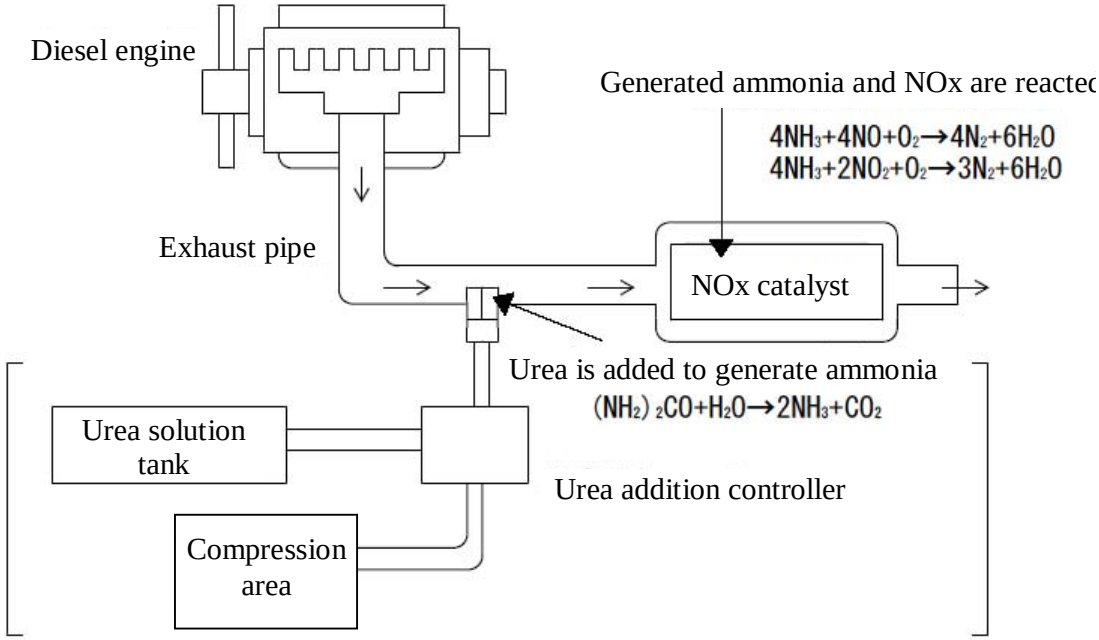

Fig. 2 Example of Urea Selective Catalytic Reduction (Urea SCR)

Meanwhile, diesel particulate filters (hereinafter referred to as “DPF”), which are used as a measure to counter PM, are expected to be employed in vehicles which comply with regulations in accordance with new long-term targets, except for some vehicle categories, and are a technology which has already been commercialized. The purifying performance of DPFs may be further improved in the future by further technological progress and reformulation of fuels and lubricants.

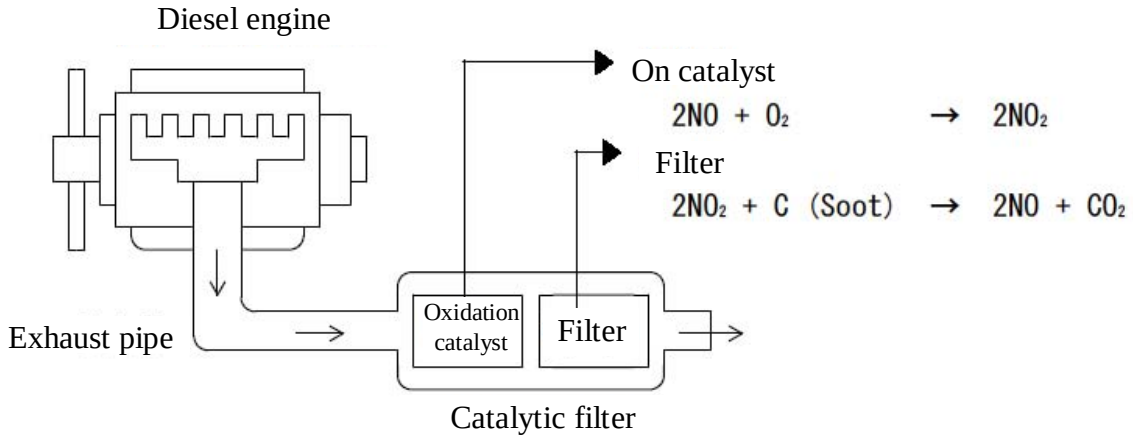

Fig. 3 Example of a Diesel Particulate Filter (DPF)

There are fears that a dramatic reduction in NOx will worsen fuel-efficiency, but it is hoped that this will be suppressed by future technological developments based on the widespread use of diesel fuel with a sulfur content of 10 ppm or less.

1.2 Permissible Limit Target Levels for Motor Vehicle Emission

In order to ensure that environmental quality standards for nitrogen dioxide (NO_2) and suspended particulate matter (hereinafter referred to as "SPM") are largely attained in FY 2010 and maintained in subsequent years, it is necessary to set permissible limit target levels for NOx and PM beyond the new long-term targets.

(Targets and Timetable for Achievement)

In the light of the potential for future progress in technological development, it is deemed appropriate that efforts be made to reduce PM and other emissions in line with the permissible limit target levels set forth in Appendix 1 (hereinafter referred to as "Diesel 2009 Targets") as a rule by the end of 2009.

Diesel motor vehicles are more fuel efficient than gasoline motor vehicles, so from the perspective of preventing global warming, diesel motor vehicles, especially passenger cars, have been the focus of attention in recent years. If regulations are implemented on the basis of these Diesel 2009 Targets, the permissible limit targets for emissions from diesel motor vehicles will be brought on par with those for gasoline motor vehicles, except for some minor differences between substances.

However, with regard to the timetable for achievement of these targets, for trucks and buses with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg (hereinafter referred to as "medium-duty vehicles") and trucks and buses with a gross vehicle weight exceeding 3,500 kg (hereinafter referred to as "heavy-duty vehicles"), it was deemed appropriate that target levels be established by category with the timetable divided up in detail according to gross vehicle weight, while, as a rule, setting targets as quickly as possible for vehicles which contribute a large percentage of emissions.

Specifically, for passenger cars, trucks and buses with a gross vehicle weight not exceeding 1,700 kg (hereinafter referred to as "light-duty vehicles"), medium-duty vehicles with a gross vehicle weight exceeding 2,500 kg but not exceeding 3,500 kg, and heavy-duty vehicles with a gross vehicle weight exceeding 12,000 kg, it is deemed appropriate that Diesel 2009 Targets be achieved by the end of 2009, and for medium-duty vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 2,500 kg and heavy-duty vehicles exceeding 3,500 kg but not exceeding 12,000 kg, Diesel 2009 Targets should be achieved by the end of 2010.

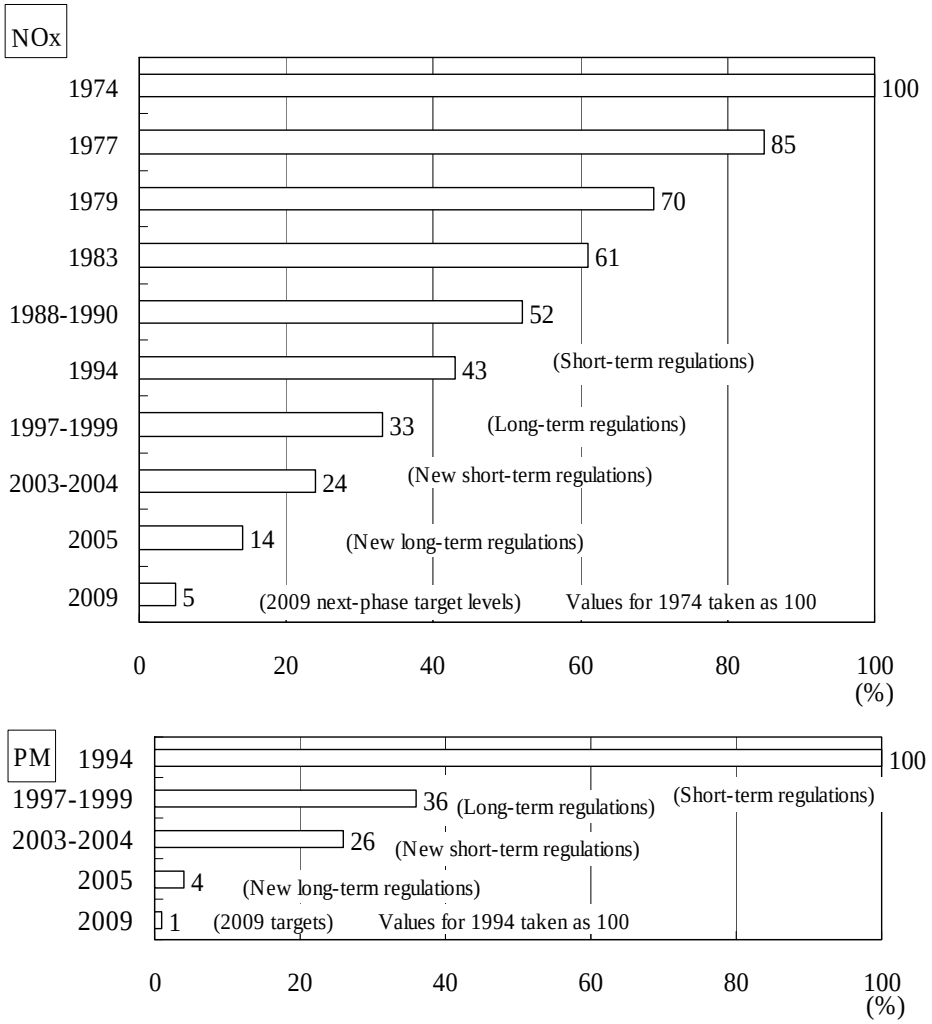

Fig. 4 Trend in the Tightening of Regulations on Diesel Heavy-Duty Vehicles

(Challenge Targets for Heavy-Duty Vehicles)

There are a large number of issues which need to be resolved for technologies to reduce NOx emissions of heavy-duty vehicles to be commercialized. Therefore, with regard to NOx target levels for heavy-duty vehicles, as described above, not only will “next-phase target levels” be set as target levels deemed achievable for the next phase by the end of 2009 or the end of 2010, but at the same time “challenge target levels” shall be indicated as higher, challenging future targets in the hope of further technological developments.

Of these, the “challenge target levels” are at about one-third the level of “next-phase target levels,” and in implementing these targets, by 2008, the state of technological development and possibility of achieving challenge target levels at that point in time should be verified, and while taking into account the state of improvement to the air

environment, especially in major urban areas, the potential for environmental improvements through localized anti-pollution measures, and the relationship with measures to reduce carbon dioxide (CO_2), target levels and the timetable for their achievement should be established while keeping a close eye on the state of improvements to fuel and lubricant quality. In this process, the establishment of permissible limit target levels for the size and quality of particles described in Section 3.2.2, including the necessity of setting such levels, shall also be studied.

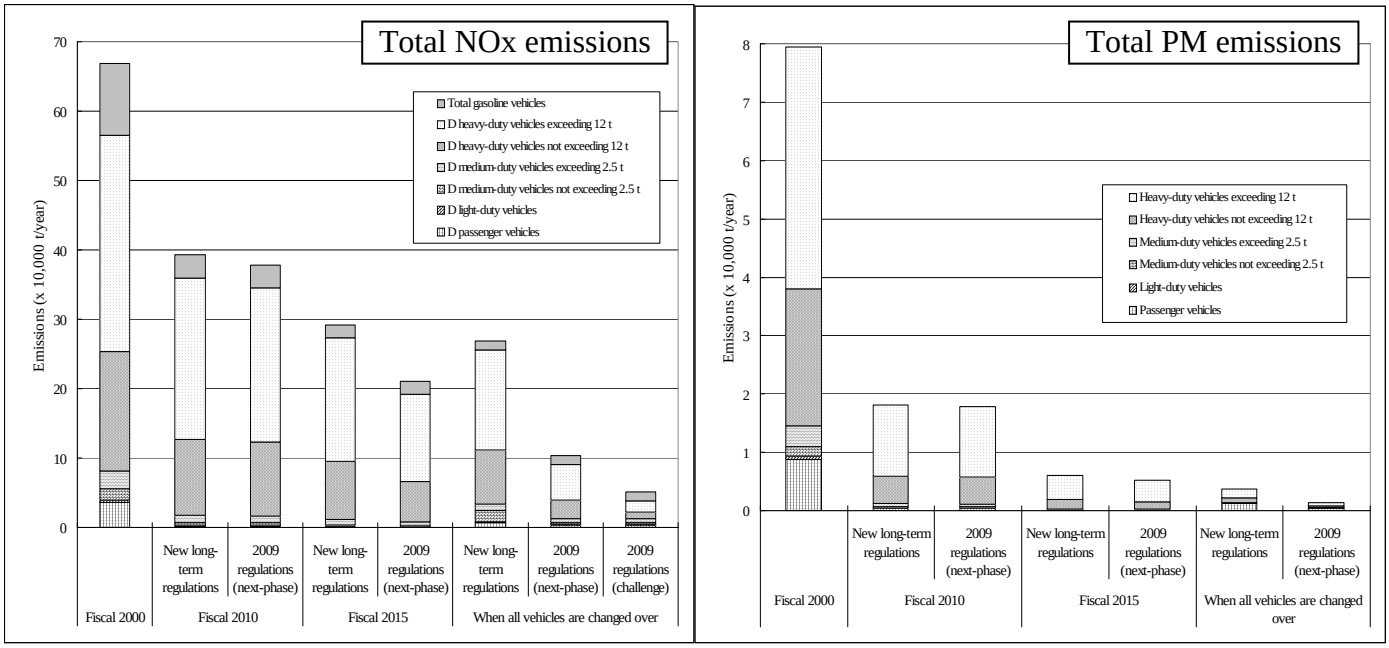

Fig. 5 Reduction Effect on Motor Vehicle Emissions Nationwide

(Other Matters)

In the United States, review is underway concerning the tightening of regulations on diesel heavy-duty vehicles from 2007 to 2010 and in Europe to tighten regulations for passenger vehicles around and after 2010 and for heavy-duty vehicles around and after 2012, and there is a need to keep a close eye on developments in these regions.

However, Japan's Diesel 2009 Targets (excluding challenge targets) aim to dramatically reduce NOx and PM, and considering the differences between Japan and other countries concerning motor vehicle emission testing methods, will prompt motor vehicle manufacturers to carry out technological development at the world's highest level.

2. Measures to Reduce Emissions from Gasoline/LPG Motor Vehicles

Of gasoline/LPG motor vehicles, for some categories of vehicles with lean-burn direct injection gasoline engines to which NOx adsorber catalysts have been fitted (hereinafter referred to as “lean-burn direct injection vehicles”), PM emissions are at the same level or higher than diesel motor vehicles fitted with DPF.

It is therefore appropriate to establish permissible limit target levels for PM at the same level as diesel motor vehicles for lean-burn direct injection vehicles, and it is important that efforts be made to reduce emissions in line with the permissible limit target levels shown in Appendix 2 (hereinafter referred to as “Gasoline 2009 Targets”) for PM by the end of 2009.

With regard to NOx and other motor vehicle emission components, permissible limit target levels shall remain unchanged, but if, for example, the market penetration of certified low-emission vehicles falls dramatically below current levels and the effectiveness of the low-emission vehicle certification system weakens, or other changes in the situation occur, the setting of these permissible limit target levels shall be studied again as necessary.

3. Motor Vehicle Emission Testing Methods and Other Related Matters

3.1 Motor Vehicle Emission Testing Methods

It is appropriate that the engine-based motor vehicle emission testing method (testing method which assesses the engine as a separate entity), which is to be introduced in conjunction with regulations based on the new long-term targets, and the chassis-based motor vehicle emission testing method (testing method which assesses the vehicle as a whole), which is scheduled for introduction in two stages in 2008 and 2011, be continued after the new long-term targets are met.

Meanwhile, as will be described in Section 4, efforts are underway to harmonize standards internationally, the results of which must also be taken into account.

3.2 PM Measurement Methods and Other Related Matters

3.2.1 PM Weight Measurement Method

If regulations are implemented based on Diesel 2009 Targets, the PM regulation levels will approach levels close to the quantitation limits of existing weight measuring methods, and it is predicted that measurement error will increase. Therefore, in setting permissible

limit target levels for PM, it is also necessary to develop a new measuring method to reduce measurement error, and to have this method serve as the official measurement method.

Improvements to measurement methods are also being examined in Europe and the United States, so in developing measurement methods it is necessary to keep a close eye on developments in these regions.

3.2.2 Setting Permissible Limit Target Levels Pertaining to Particle Size and Quality

Nowadays there is a heightening concern both within Japan and overseas that not only particle weight, but their size and quality (the number and composition of both particles with a particle diameter of 2.5 microns or less [hereinafter referred to as “fine particles”] and nanometer-sized particles [hereinafter referred to as “ultrafine particles”]) may be strongly related to health impact.

However, measurement methods have yet to be established for the size and quality of particles emitted by diesel motor vehicles, and there is a lack of knowledge on this subject both within Japan and overseas concerning the actual state of emission and the different health impacts according to differences in particle size and quality.

For the reasons outlined above, at this stage it is difficult to set permissible limit target levels pertaining to particle size and quality. However, from a precautionary perspective, it is necessary to work toward reducing PM as much as possible for the time being, for government, industry, and academia to join forces to promote research concerning the establishment of measurement methods as well as to gain a clear picture of the emissions and their health impact reflecting the size and quality of particles such as fine particles and ultrafine particles, and to examine the necessity of setting permissible limit target levels based on these results.

3.3 Other Matters

3.3.1 Onboard Diagnostic Systems

For gasoline/LPG motor vehicles, so-called advanced onboard diagnostic systems (hereinafter referred to as “OBD systems”), with the capacity to automatically detect and notify the driver of deterioration in the performance of motor vehicle emission control devices such as catalyst systems, are to be fitted to passenger vehicles, light-duty vehicles, and medium-duty vehicles manufactured in 2008 and beyond.

Meanwhile, for diesel motor vehicles the use of DPFs and NOx reduction catalysts is expected to become more widespread in the future. Therefore, in the same way as for gasoline/LPG motor vehicles, it is appropriate that advanced OBD systems also be introduced for diesel motor vehicles to monitor functional defects in motor vehicle emission control devices, such as devices for reducing PM and catalysts for reducing NOx, to automatically detect such defects and to notify the driver.

In the future it is appropriate that the government, after examining such factors as items to be detected, detection values, and assessment methods, stipulates technological matters required by advanced OBD systems, and based on these results, automobile manufacturers and others concerned fit these advanced OBD systems to diesel motor vehicles as soon as possible.

3.3.2 Biodiesel Fuel

Past studies on fatty acid methyl esters (hereinafter referred to as “FAME”) generated from biomass such as rapeseed oil or waste cooking oil indicate that the addition of FAME to diesel fuel, without a catalyst being fitted, results in an increase of SOF (the organic compounds comprising the unburned combustible content of fuels and lubricants) compared to when diesel fuel is used alone. In addition, slight increases in NOx and carbon monoxide (CO) may occur, and an increasing tendency was observed in aldehyde and benzene which are exempt from regulations, but this study also indicated that the motor vehicle emission components which increased could be reduced by fitting a catalyst with a high oxidizing capacity. However, with the results of past surveys alone, the impact on motor vehicle emission according to the percentage of FAME added has not been quantitatively clarified.

It is therefore necessary that catalysts with high oxidizing capacity are fitted when using FAME as a substitute for or additive to diesel fuel, and it is appropriate that this be communicated thoroughly to users. However, on the basis of results of studies carried out up until now, it is difficult to set upper limits for the quantity of FAME added to diesel fuel, i.e. permissible limit target levels for fuel relating to FAME.

The setting of permissible limit target levels for fuel should be examined as necessary, based on the future take-up of FAME and progress in research concerning the impact of FAME on motor vehicle emissions.

4. International Harmonization of Standards

Based on the purpose of the Agreement on Technical Barriers to Trade (which came into effect on January 1, 1995), the objective of which is to ensure that standard certification systems do not generate unnecessary obstacles to international trade, it is desirable that international harmonization of standards be promoted wherever possible within a scope which does not hinder Japan's environmental preservation.

Therefore an active contribution should be made to the international harmonization of standards for emission testing methods for large trucks, OBD systems, measures for controlling off-cycle emissions, and emission testing methods for two-wheeled motor vehicles, among others, which are currently underway at the World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe (UN-ECE/WP29), and efforts should be made to promote international harmonization of standards to the greatest degree possible.

Of these, for heavy-duty vehicles, it is desirable that the progress in international developments to harmonize standards be taken into account, at least in examining the challenge targets and their timetable for achievement for heavy-duty vehicles laid down in Section 1.2.

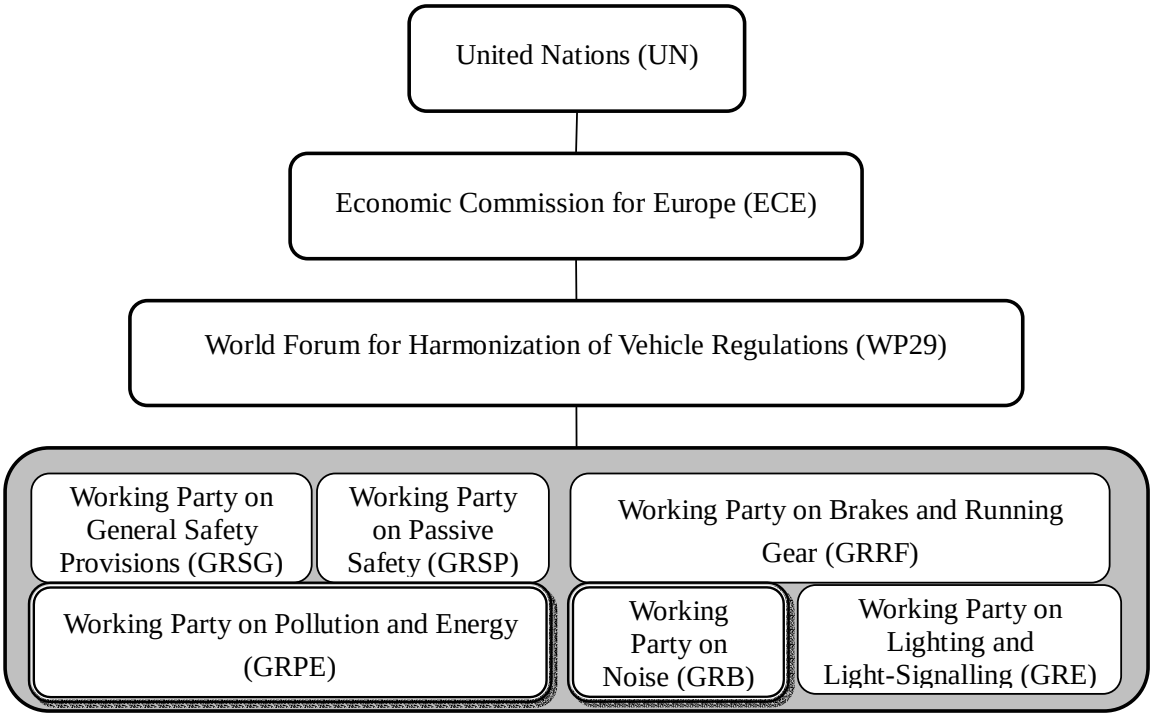

Fig. 6 Framework for International Harmonization of Standards Concerning Motor Vehicles

5. Future Measures to Reduce Motor Vehicle Emissions

Issues which require further study in order to maintain environmental quality standards in 2010 and beyond are set forth in Section 5.1. Moreover, if improvements are to be made to the air environment, especially in major urban areas, and residents are to enjoy a good living environment, not only motor vehicle emission regulations, but also various air pollution control measures and related policies will need to be promoted in the future, and the issues to be addressed in doing so are set forth in Section 5.2.

5.1 Future Issues to Be Studied

(1) With regard to diesel motor vehicles, the setting of new permissible limit target levels should be studied as necessary while keeping a close eye on the potential for technological development, the state of improvement in the air environment with a view to achieving environmental quality standards for the air environment, and the outlook for improvements following the Diesel 2009 Targets, while giving maximum consideration to the compatibility of fuel-efficiency technology and motor vehicle emission reduction technologies. This should include a study of measures to address fuel and lubricant quality based on research into the effect in reducing motor vehicle emissions conducted under the cooperation of the government, motor vehicle manufacturers, fuel producers, and others.

(2) With regard to gasoline/LPG motor vehicles, the setting of new permissible limit target levels should be studied as necessary while keeping a close eye on the potential for technological development and the state of improvement in the air environment with a view to achieving environmental quality standards for the air environment, while giving maximum consideration to the compatibility of fuel-efficiency technology and motor vehicle emission reduction technologies.

In addition, with regard to measures to reduce evaporative emissions when filling vehicles with gasoline/LPG, the introduction of regulations will be examined as necessary based on the degree of contribution to overall emissions of hydrocarbons (hereinafter referred to as “HC”) and the progress in HC measures for other emission sources.

(3) With regard to diesel fuel-powered special motor vehicles, the potential for application of exhaust after-treatment devices to special motor vehicles will be analyzed in detail, and the setting of new permissible limit target levels to be achieved by around 2010 will be

examined.

In addition, for gasoline- or LPG-powered special vehicles, the setting of new permissible limit target levels should be studied as necessary.

(4) With regard to those special vehicles having a rated engine output of less than 19 kW or of 560 kW or more, and general-purpose engines other than special motor vehicles, for which permissible limit target levels have not been set at this point in time, the introduction of motor vehicle emission regulations should be studied as necessary, while monitoring such developments as the state of air pollution; the rate of contribution to emissions; the effect of the Land, Infrastructure and Transport Ministry's Designation System for Emission Control Type Construction Machinery; the state of implementation of voluntary initiatives concerning emissions of general-purpose diesel engines with an output of less than 19 kW, which are to be implemented by the Japan Land Engine Manufacturers Association; and the state of development of motor vehicle emission control technologies.

(5) With regard to two-wheeled motor vehicles, monitoring will be conducted of the response to regulations based on the permissible limit target levels recommended in the Sixth Report, the potential for further technological development, and the efficacy of various types of measures, and new permissible limit target levels will be considered as needed.

(6) Of the biomass fuels, for which there have been high expectations in recent years from the perspective of preventing global warming, the potential for usage of E10 (fuel in which bioethanol has been added up to 10% by volume to gasoline) will be reviewed in the future as necessary, taking into account the state of motor vehicle technological development supporting this fuel (including technologically advanced measures which satisfy motor vehicle emission regulations based on the premise of conventional gasoline engines) and the supply framework for E10. In addition, new fuels such as gas-to-liquid (GTL), dimethyl ether (DME), and ethyl tertiary butyl ether (ETBE) should be examined as necessary, based on market developments.

5.2 Future Issues to Be Addressed concerning Related Measures

As policies to complement the measures set forth in this report, the related measures discussed below should be promoted to a greater extent in the future.

(1) Promotion of Comprehensive Measures to Reduce Motor Vehicle Emissions Such as Policies in Accordance with the Automobile NOx/PM Law

In addition to measures to reduce motor vehicle emissions for each new vehicle sold, the following measures which are expected to take on increasing importance in the future should be implemented.

(i) (a) Controls by category of motor vehicles should be steadily implemented in accordance with the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas (Law No. 70, 1992), and comprehensive measures such as the enhancement of measures to suppress motor vehicle emissions generated by businesses and the promotion of low-pollution vehicles should be taken, and the efficacy of these measures should be studied.

(b) Such measures as facilitating the flow of traffic, suppressing traffic volume, and improving road structure and urban structure should be actively studied and implemented.

(ii) Comprehensive measures concerning vehicles in use, such as setting motor vehicle emission levels concerning vehicles in use and policies for the introduction of surveillance, should be examined as soon as possible, including the need for such measures.

(iii) In addition to fuel-efficiency measures, measures should be promoted to support “idle-stop” and other ecology-conscious measures from the perspective of measures to reduce motor vehicle emissions.

(2) Status Surveys and Improvements to Measurement Accuracy

Efforts must be made to develop and improve a framework to asses the effect of measures in roadside and other locations.

(3) Measures for Unregulated Pollutants

(i) With regard to unregulated hazardous air pollutants emitted from motor vehicles, efforts must be made to develop measurement methods and to improve measurement accuracy, while at the same time gaining a clear picture of the impact of such factors as engine combustion technology, catalysts and other exhaust after-treatment devices, and fuel and lubricant quality on the quantity of hazardous air pollutants emitted from motor vehicles.

(ii) With regard to unregulated emission sources other than motor vehicles, there is a need to continue surveying the state of emissions and examining the need for measures, and to study the blueprint for a system to implement such measures.

(4) Financial and Tax Incentives

It will also be necessary to put in place financial and tax incentives, including appropriate support for the technological development of vehicles, to ensure that improvement of fuel quality, as well as replacement of old vehicles by new ones in compliance with the latest regulations, proceed smoothly. Efforts must be made toward the establishment of such incentives.

Appendix 1

Permissible Limit Target Levels for Diesel Motor Vehicle Emissions

(Diesel 2009 Targets)

Motor vehicle category		Permissible limit target level for emissions (average level)			
		Nitrogen oxides	Non-methane hydrocarbons	Carbon monoxide	Particulate matter
Diesel fuel-powered ordinary-sized motor vehicles and small-sized motor vehicles exclusively for passenger use, with a capacity not exceeding 10 persons (excluding two-wheeled motor vehicles)		0.08g/km	0.024g/km	0.63g/km	0.005g/km
Diesel fuel-powered ordinary-sized motor vehicles and small-sized motor vehicles (excluding vehicles exclusively for passenger use with a capacity not exceeding 10 persons and two-wheeled motor vehicles)					
	Vehicles with a gross vehicle weight not exceeding 1,700 kg	0.08g/km	0.024g/km	0.63g/km	0.005g/km
	Vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg	0.15g/km	0.024g/km	0.63g/km	0.007g/km
	Vehicles with a gross vehicle weight exceeding 3,500 kg	0.7g/kWh (Next-phase target level) Approximately one-third of 0.7g/kWh (Challenge target level)	0.17g/kWh	2.22g/kWh	0.01g/kWh

* Underlined target levels are permissible limit target levels whose numerical values have changed since the new long-term targets for diesel motor vehicles.

* With regard to permissible limit target levels for vehicles having a gross vehicle weight not exceeding 3,500 kg, from 2008 levels will be calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the 10/15 mode measurement value by 0.75, while from 2011 onward the value applied will be the value calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the value measured while warm using the new testing mode by 0.75.

* With regard to challenge target levels, after verifying values in around 2008, target levels and the timetable for achievement should be finalized as necessary.

Appendix 2

Permissible Limit Target Levels for Gasoline/LPG Motor Vehicle Emissions

(Gasoline 2009 Targets)

Motor vehicle category	Permissible limit target level for emissions (average level)			
	Nitrogen oxides	Non-methane hydrocarbons	Carbon monoxide	Particulate matter (Note)
Gasoline- or LPG-powered ordinary-sized, small-sized and mini-sized vehicles, exclusively for passenger use, with a capacity not exceeding 10 persons (excluding two-wheeled motor vehicles)	0.05g/km	0.05g/km	1.15g/km	<u>0.005g/km</u>
Gasoline- or LPG-powered mini-sized vehicles (excluding vehicles exclusively for passenger use, vehicles equipped with two-stroke engines and two-wheeled motor vehicles)	0.05g/km	0.05g/km	4.02g/km	<u>0.005g/km</u>
Gasoline- or LPG-powered ordinary-sized and small-sized vehicles (excluding vehicles exclusively for passenger use with a capacity not exceeding 10 persons, and two-wheeled motor vehicles)				
Vehicles with a gross vehicle weight not exceeding 1,700 kg	0.05g/km	0.05g/km	1.15g/km	<u>0.005g/km</u>
Vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg	0.07g/km	0.05g/km	2.55g/km	<u>0.007g/km</u>
Vehicles with a gross vehicle weight exceeding 3,500 kg	0.7g/kWh	0.23g/kWh	16.0g/kWh	<u>0.01g/kWh</u>

* Underlined target levels are permissible limit target levels whose numerical values have changed since the new long-term targets for gasoline/LPG motor vehicles.

* With regard to permissible limit target levels for vehicles having a gross vehicle weight not exceeding 3,500 kg, from 2008 levels will be calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the 10/15 mode measurement value by 0.75, while from 2011 onward the value applied will be the value calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the value measured while warm using the new testing mode by 0.75.

(Note) Permissible limit target levels for particulate matter are only applied to lean-burn direct injection vehicles fitted with NOx adsorber catalysts.

Future Policy for
Motor Vehicle Emission Reduction

(Eighth Report)

February 22, 2005

Experts Committee on Motor Vehicle Emissions
Air Environment Committee
Central Environment Council

Future Policy for Motor Vehicle Emission Reduction
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(Contents)

1. The Necessity for Further Strengthening of Measures to Reduce Motor Vehicle Emissions

In Japan, a variety of air pollution controls have been implemented, such as tightening motor vehicle emission regulations, but air pollution by suspended particulate matter (hereinafter referred to as "SPM") and nitrogen dioxide (NO_2) and the like remains at high levels, especially in major urban areas. In particular, with regard to SMP and NO_2 in the roadside air environment, particulate matter (hereinafter referred to as "PM") and nitrogen oxides (hereinafter referred to as "NOx") emitted from diesel fuel-powered motor vehicles (excluding special motor vehicles, hereinafter referred to as "diesel motor vehicles") are largely responsible for pollution, and suppressing the emissions of PM and NOx from diesel motor vehicles is an important issue which must be addressed.

In the past, a wide range of air pollution control measures were carried out with 1985 and fiscal year 2000 as target years for the achievement of most of environmental quality standards for NO_2. However, dramatic increases in the number of motor vehicles owned and the motor vehicle traffic volume, traffic congestion, etc., have prevented these targets from being achieved.

At this point in time, for diesel motor vehicles and motor vehicles which use gasoline or liquefied petroleum gas (hereinafter referred to as "LPG") as fuel (excluding two-wheeled motor vehicles and special motor vehicles, hereinafter referred to as "gasoline/LPG motor vehicles"), gasoline-powered two-wheeled motor vehicles and motor-driven cycles (hereinafter referred to as "two-wheeled vehicles"), diesel fuel-powered special motor vehicles (hereinafter referred to as "special diesel motor vehicles") and gasoline- or LPG-powered special motor vehicles (hereinafter referred to as "special gasoline/LPG motor vehicles"), targets are indicated for 2005 to around 2008 in the notification Permissible Limits for Motor Vehicle Emission (Environment Agency Notification No. 1, January 1974, hereinafter referred to as "permissible limits") based on the Air Pollution Control Law (Law No. 97 of 1968).

In addition, as a measure for vehicles in use, controls according to motor vehicle category which regulate the ownership and use in specific areas of vehicles which have been used for a given number of years have been implemented since December 1993 in accordance with the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides from Automobiles in Specified Areas (Law No. 70 of 1992, hereinafter referred to as the "Automobile NOx Law). Moreover, new controls by category of motor

vehicles were enforced from October 2002 based on the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas (hereinafter referred to as the "Automobile NOx/PM Law"), which amended the Automobile NOx Law and expanded the scope of applicable substances, among others.

Currently a policy has been adopted aiming to largely attain the environmental quality standards for NO_2 and SPM by FY 2010 based on the pillars of three policies: motor vehicle emission regulations on new vehicles, regulations on vehicles in use in specific areas, and measures to promote the use of low-pollution vehicles.

In regions such as Tokyo that suffer marked air pollution, plans for reducing total automobile nitrogen oxide and particulate matter emissions have been formulated and are being implemented by municipalities throughout the country in a bid to achieve environmental quality standards for NO_2 and SPM at nearly all roadside air pollution monitoring stations by FY 2010 through government regulations in accordance with new long-term targets and independent initiatives of municipalities. In addition, the Japan Automobile Manufacturers Association has made the independent forecast that environmental quality standards will be met at almost all roadside air pollution monitoring stations except for some stations in Tokyo's 23 wards by 2010. (Note 1) (Note 2)

Against this backdrop, with the view that additional measures must be implemented in order to ensure that environmental quality standards are largely attained by FY 2010 and maintained in subsequent years, in addition to the aforementioned measures for motor vehicles, the government is starting to implement all measures deemed possible at this point in time, such as deciding to start on measures to suppress emissions from factories relating to volatile organic compounds (hereinafter referred to as "VOC"), which are a source of SPM. In addition, with regard to measures to reduce emissions from diesel motor vehicles, as described in Section 3, there is a need for further measures beyond the regulations based on new long-term targets.

In the light of this situation, the Central Environment Council's Air Environment Committee and the Expert Committee on Motor Vehicle Emissions (hereinafter referred to as the "Expert Committee") established within the auspices of the Air Environment Committee, as indicated in the Seventh Report (Chukanshin No. 142 of

July 29, 2003) (Note 3), have taken the view that the development of exhaust after-treatment devices must be promoted and their rapid introduction encouraged if emissions from diesel motor vehicles are to be reduced dramatically, and based on the premise that diesel fuel sulfur content will be reduced to 10 ppm or less from 2007, the committees decided to examine measures to reduce motor vehicle emissions beyond the new long-term targets.

(Note 1) In forecasting the achievement of environmental quality standards for SPM, the Japan Automobile Manufacturers Association employs an exclusion value of only 2% annually. These forecasts therefore do not consider the situation wherein even if an annual exclusion value of 2% falls below environmental standards, if environmental standards are exceeded for two consecutive days, environmental standards are not deemed to be achieved.

(Note 2) Future traffic volume/vehicle category breakdown data which forms the premises for estimating future motor vehicle emissions was estimated based on survey results carried out in JCAP (Japan Clean Air Program) 1. (see Note 4 to Note 6 in Section 3.3)

(Note 3) The Seventh Report indicates the following:

"1.2. Measures to Reduce Emissions Beyond the New Long-Term Targets

Regarding the establishment of new target levels beyond the new long-term targets and a timetable for meeting them, in addition to encouraging technological development by motor vehicle manufacturers through the reduction of diesel fuel sulfur content to 10 ppm or less, the council should study the issue further on the basis of technological assessments as well as an evaluation of the new long-term targets, the regulations by vehicle category instituted under the Automobile NOx/PM Law, and traffic control measures in terms of their efficacy in improving air quality, with the aim of reaching a conclusion as soon as possible. (The rest is omitted.)"

(Study Background and Summary of This Report)

In accordance with the guidelines for future study recommended in the Seventh Report, this Committee met for deliberation on 32 occasions, including hearings attended by industry groups and discussions by the working committee established within this Committee. The conclusions it reached concerning motor vehicle emission testing methods are detailed in Section 2, measures to reduce motor vehicle emissions from diesel motor vehicles in Section 3, measures for reducing emissions from gasoline/LPG

motor vehicles in Section 4, international harmonization of standards in Section 5, topics for future study in Section 6.1, and related measures in Section 6.2.

2. Motor Vehicle Emission Testing Methods and Other Related Matters

Motor vehicle emission testing methods and fuel quality, etc. are prerequisites for the setting of permissible limit target levels. Therefore the following explains the results of discussions by the Expert Committee concerning motor vehicle emission testing methods in examining measures to reduce emissions from diesel motor vehicles in Section 3 and measures to reduce emissions from gasoline/LPG motor vehicles in Section 4.

2.1 Motor Vehicle Emission Testing Methods

The engine-based motor vehicle emission testing method (testing method which assesses the engine as a distinct entity, hereinafter referred to as "JE05 Mode"), which is to be introduced in conjunction with the regulations based on new long-term targets, and the chassis-based motor vehicle emission testing method (testing method which applies to the assessment of the vehicle as a whole), which is scheduled for introduction in two stages in 2008 and 2011, will be employed as testing methods which reflect accurately and in detail recent running conditions, and appropriately assess both motor vehicle emission control technologies including the increasing accuracy of electronic control or the use of new exhaust after-treatment devices and the resultant changes in motor vehicle emission performance.

Beyond new long-term targets, it is deemed appropriate that these motor vehicle emission testing methods be continued for the following reasons:

- There are assumed to be no dramatic changes in running conditions.
- Although there will be additional vehicle emission control technologies to those assumed when motor vehicle emission testing methods were formulated, these will not require changes to testing methods.

The motor vehicle emission testing methods of individual countries reflect the actual state of running of motor vehicles in the particular country, and hence vary from country to country. Therefore, when making a comparison of the values which appear in regulations and standards, care needs to be taken that a comparison of the true strictness of regulations (absolute level) cannot be made by an international

comparison of the numerical values of regulations and standards alone. For example, Japan's JE05 Mode has a lower average vehicle speed than those of European countries and the United States. As a consequence, motor vehicle emissions become higher during low-speed running where the activity levels of catalysts are lower. As a result, there is also data that indicates that if tests are carried out using vehicles with the same specifications, differences in motor vehicle emission testing methods may generate large differences particularly in NOx emissions. Meanwhile, as outlined in Section 5, efforts are continuing to promote the international harmonization of standards, the results of which must also be taken into account.

2.2 PM Measurement Methods and Other Related Matters

2.2.1 PM Weight Measurement Method

If PM is reduced dramatically below new long-term targets, the quantitation limits of existing weight measuring methods will be approached, and it is predicted that measurement error will increase. Therefore, in setting permissible limit target levels for PM, it is also necessary to develop a new measuring method to reduce measurement error, and to have such method serve as the official measurement method.

Improvements to measurement methods are also being examined in Europe and the United States, so in developing measurement methods it is necessary to keep a close eye on developments in these regions.

2.2.2 Setting Permissible Limit Target Levels Pertaining to Particle Size and Quality

Nowadays there is a heightening concern both within Japan and overseas that not only particle weight, but their size and quality (the number and composition of both particles with a particle diameter of 2.5 microns or less [hereinafter referred to as "fine particles"] and nanometer-sized particles [hereinafter referred to as "ultrafine particles"]) may be strongly related to health impact. In response, research is actively being carried out with a view to establishing measurement methods which take into account the size and quality of particles, and internationally the subject is being reviewed centering on the World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe (hereinafter referred to as "UN-ECE/WP29").

However, measurement methods have yet to be established for the size and quality of particles emitted by diesel motor vehicles, and the actual state of emission of these particles has not been adequately clarified. There are also indications that ultrafine

particles are emitted from vehicles with lean-burn gasoline direct injection engines (hereinafter referred to as "lean-burn direct injection vehicles") fitted with catalyst systems which reduce NOx by adsorption or absorption into catalysts (hereinafter referred to as "NOx adsorber catalysts"), and the actual state of emission from such vehicles has not been clarified either. There is also a need for long-term epidemiological study into differences in the health impact according to the size and quality of particles, and there is a lack of knowledge on this subject both within Japan and overseas.

For the reasons outlined above, at this stage it is difficult to set permissible limit target levels pertaining to particle size and quality. However, from a precautionary perspective, it is necessary to work toward reducing PM as much as possible for the time being, for public and private sectors to join forces to promote research concerning the establishment of measurement methods and to gain a clear picture of the emissions and their health impact reflecting the size and quality of particles such as fine particles and ultrafine particles and to examine the necessity of setting permissible limit target levels based on these results.

2.3 Other Matters

2.3.1 Onboard Diagnostic Systems

Under regulations in accordance with new short-term targets, the fitting of onboard diagnostic systems (hereinafter referred to as "OBD systems") is mandatory for gasoline/LPG motor vehicles and diesel motor vehicles. These systems monitor defects in the function of motor vehicle emission control devices caused by disconnection of various sensors and other reasons.

Moreover, for gasoline/LPG motor vehicles, so-called advanced OBD systems with the capacity to automatically detect and notify the driver of deterioration in the performance of motor vehicle emission control devices such as catalyst systems, are to be fitted to passenger cars and trucks/buses with a gross vehicle weight not exceeding 1,700 kg (hereinafter referred to as "light-duty vehicles") and trucks/buses with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg (hereinafter referred to as "medium-duty vehicles") manufactured in 2008 and beyond.

Meanwhile, for diesel motor vehicles the use of diesel particulate filters for reducing PM (hereinafter referred to as "DPF") and catalyst systems for reducing NOx (hereinafter referred to as "NOx reduction catalysts") is expected to become more widespread in the future. There is a danger that the effectiveness of measures to

reduce motor vehicle emissions will dramatically decrease if the function of these motor vehicle emission reduction devices diminishes. Therefore, in the same way as for gasoline/LPG motor vehicles, it is appropriate that advanced OBD systems also be introduced for diesel motor vehicles to monitor functional defects in motor vehicle emission control devices, such as devices for reducing PM and catalysts for reducing NOx, to automatically detect such defects and to notify the driver.

In the future it is appropriate that the government, after examining such factors as items to be detected, detection values and assessment methods, stipulates technological matters required by advanced OBD systems, and based on these results, automobile manufacturers and others concerned fit these advanced OBD systems to diesel motor vehicles as soon as possible.

2.3.2 Biodiesel Fuel

Recent years have seen a growing level of attention attracted to so-called biodiesel fuel, fatty acid methyl esters (hereinafter referred to as "FAME") generated from biomass such as rapeseed oil or waste cooking oil. This biodiesel fuel is used as a substitute for or an additive to diesel fuel in a bid to prevent global warming and promote recycling. However, the impact on motor vehicle emission performance when FAME is used has yet to be adequately verified.

The Seventh Report, although based on limited data, indicated that the addition of FAME to diesel fuel results in a slight increase in NOx, and that depending on conditions, organic compounds comprising unburned combustible components of fuels and lubricants in PM (hereinafter referred to as "SOF") may increase. The same report recommended a detailed examination of the impact on motor vehicle emissions if FAME be used in the future, and also reported that it deemed it appropriate that a conclusion be reached as soon as possible concerning the setting of targets based on Maximum Permissible Limits for the Quality of Motor Vehicle Fuel and for the Quantity of Substances in Motor Vehicle Fuel (Environment Agency Notification No. 64, October 1995, hereinafter referred to as "permissible limits for fuel") with regard to the use of FAME.

Based on this situation, the following conclusions were reached after having examined the impact of the use of FAME on motor vehicle emissions.

Following on from FY 2002, according to the "FY 2003 Fact-Finding Survey concerning Exhaust Gasses of New Fuels" carried out jointly by the Ministry of Environment and the Ministry of Land, Infrastructure and Transport, the addition of FAME to diesel fuel, without a catalyst being fitted, results in an increase in SOF in PM compared to when diesel fuel is used alone, and NOx and carbon monoxide (CO) may increase slightly, and an increasing tendency was observed for aldehyde and benzene which are exempt from regulations. However, this survey also indicated the possibility that these motor vehicle emission components which increased could be reduced by fitting a catalyst with a high oxidizing capacity. As a consequence, it was deemed appropriate to thoroughly communicate that when using FAME as a substitute for diesel fuel or as an additive to diesel fuel, it is necessary to fit a catalyst with a high oxidizing capacity. However, with the results of past surveys alone, the impact on motor vehicle emission according to the percentage of FAME added has not been quantitatively clarified.

In addition, FAME is used in a limited range, such as by municipalities. Within such a range, based on the impact of the use of FAME on motor vehicle emissions, hopes are held that FAME will be used appropriately by reminding users of such matters as the need to install catalysts with high oxidizing capacity.

For the reasons outlined above, while it is necessary to carry out adequate education concerning the appropriate use of FAME, on the basis of results of surveys carried out up until now, it is difficult to set upper limits for the quantity of FAME added to diesel fuel, i.e. permissible limit target levels for fuel relating to FAME. The setting of permissible limit target levels for fuel relating to FAME shall be examined as necessary, based on the future take-up of FAME and progress in research concerning the impact of FAME on motor vehicle emissions.

3. Measures to Reduce Emissions from Diesel Motor Vehicles

As outlined in Sections 1 and 3.3, to ensure that environmental quality standards for air pollution are largely attained by FY 2010 and maintained in subsequent years, measures to reduce motor vehicle emissions are necessary, and measures are particularly important for diesel motor vehicles which account for a large percentage of NOx and PM emissions. Therefore, based on the premise that permissible limit target levels for PM and NOx will be set beyond new long-term targets, the Expert Committee established an outlook for motor vehicle emission control technologies, carried out review from the perspective of achieving quality standards for the air environment in general by FY 2010, and reports the following conclusions.

Measures to reduce emissions from diesel motor vehicles are a pressing issue, so permissible limit target levels should be tightened. However, consideration must be given to the following:

- Diesel motor vehicles are more fuel efficient than gasoline motor vehicles, so from the perspective of preventing global warming, diesel motor vehicles, especially passenger cars, have been the focus of attention in recent years.
- A dramatic reduction in motor vehicle emissions has the side-effect of worsening fuel efficiency.

Therefore, the relationship with worsening fuel efficiency shall be indicated as far as possible at this point in time in this report.

3.1 Motor Vehicle Emission Reduction Technologies

Currently the main motor vehicle emission reduction technologies used in diesel motor vehicles are technologies which reduce the gases emitted from engines per se and so-called exhaust after-treatment technology which purifies the gases emitted from engines before they reach the exhaust pipe outlet.

Among the former, further increasing the pressure of fuel injection and optimization of the shape of combustion chambers are given as PM measures, and elaborating fuel injection rate shaping by electronic control and cooling and increasing the volume of gas recirculated in exhaust gas recirculation (hereinafter referred to as "EGR") systems, etc. are given as NOx measures, and technological improvements are being encouraged for the various areas. In addition, research and development is underway with a view to commercializing homogeneous charge compression ignition mainly for low load, low engine speed applications.

In order to dramatically reduce the PM and NOx emitted from diesel motor vehicles, because there are limits to what can be achieved solely by improving technologies to reduce emissions from engines as described above, the introduction of exhaust after-treatment devices is essential. Among exhaust after-treatment devices, as NOx reduction catalysts, NOx adsorber catalysts and a catalyst system which adds urea to reduce NOx (hereinafter referred to as "Urea SCR") are being introduced in phases.

NOx adsorber catalysts use technology which is implemented in gasoline-powered motor vehicles (excluding two-wheeled motor vehicles and special motor vehicles, hereinafter referred to as "gasoline motor vehicles"), but they are susceptible to sulfur

poisoning. In addition, maintaining NOx purification performance and improving catalyst durability, as well as minimizing the decrease in fuel efficiency caused by fuel injection for desulfurization (hereinafter referred to as "desulfurization control") and fuel injection to reduce NOx (hereinafter referred to as "rich spike"), are issues which must be addressed. It is therefore hoped that with the use of diesel fuel with a sulfur content of 10 ppm or less becoming widespread as described in Section 1, sulfur poisoning of catalysts will be alleviated, in turn making it possible to reduce both the frequency of desulfurization control and rich spikes by maintaining the NOx adsorption capacity of catalysts, and therefore minimizing the decline in fuel efficiency.

Urea SCR uses technologies commercialized for large-scale combustion devices used in ships and the like and for stationary diesel engines. Generally, oxidation catalysts are positioned before and after Urea SCR in order to improve the NOx purifying performance in Urea SCR and to eliminate emissions of unreacted ammonia. It is therefore preferable that diesel fuels have a low sulfur content in order to improve the reactivity of oxidation catalysts and to suppress the generation of sulfates, and it is hoped that purifying performance and durability will improve with the increasingly widespread use of diesel fuel with a sulfur content of 10 ppm or less.

Meanwhile, DPFs, which are used as a measure to counter PM, are expected to be employed in vehicles which comply with regulations in accordance with new long-term targets, except for some vehicle categories, and are a technology which has already been commercialized. The purifying performance of DPF may be further improved in the future by further technological progress and improvements in the quality of fuels and lubricants.

3.2 Permissible Limit Target Levels for Motor Vehicle Emission

(Targets and Timetable for Achievement)

While bearing in mind the necessity for measures to reduce motor vehicle emissions described in Section 1, review was carried out on the motor vehicle emission control technologies described in Section 3.1 based on the premise that the sulfur content of diesel fuel will be reduced to 10 ppm or less nationwide from 2007, taking into account the potential for future progress in those technologies.

As a result, the judgment was made that it is appropriate to reduce PM and other emissions in line with the permissible limit target levels (hereinafter referred to as "Diesel 2009 Targets") described in Appendix 1 (see page 31) as a rule by the end of

2009. If regulations are implemented on the basis of these Diesel 2009 Targets, the permissible limits for emissions from diesel motor vehicles will be brought on par with those for gasoline motor vehicles, except for some minor differences between substances.

However, for medium-duty vehicles and trucks/buses with a gross vehicle weight exceeding 3,500 kg (hereinafter referred t as "heavy-duty vehicles"), despite the need for an adequate verification period to confirm the durability of exhaust after-treatment devices after traveling the long distances assumed for such vehicles, at this point in time the verification of these devices remains inadequate, and a considerable preparation time is required in the future. With regard to medium-duty vehicles, timetables for compliance with changes to motor vehicle emission testing methods and compliance with regulations based on Diesel 2009 Targets will overlap, which is forecast to result in an increased burden resulting from a dramatic increase in man-hours required for a period of time. In order to address these issues, it was deemed appropriate that while as a rule setting targets as quickly as possible for vehicles which contribute a large percentage of emissions, setting be carried out by category with the timetable divided up in detail according to gross vehicle weight.

Specifically, for passenger cars, light-duty vehicles, medium-duty vehicles with a gross vehicle weight exceeding 2,500 kg but not exceeding 3,500 kg, and heavy-duty vehicles with a gross vehicle weight exceeding 12,000 kg, it is deemed appropriate that Diesel 2009 Targets be achieved by the end of 2009, and for medium-duty vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 2,500 kg and heavy-duty vehicles exceeding 3,500 kg but not exceeding 12,000 kg, Diesel 2009 Targets should be achieved by the end of 2010.

(Future Outlook for Motor Vehicle Emission Control Technologies)
In setting the Diesel 2009 targets, as described in Section 3.1, DPFs are already being employed except in some vehicle categories as a technology to ensure compliance with regulations in accordance with new long-term targets, and when considered together with the potential for progress in technology beyond the regulations based on new long-term targets and further reductions in the gases per se emitted from engines, a drastic reduction in PM is deemed possible.

For NOx it is hoped that NOx adsorber catalysts and Urea SCR will be commercialized. Of these two technologies, Urea SCR is being developed based on the premise of

application mainly to heavy-duty vehicles, due to such issues as fitting to vehicles and the provision of urea supply stations, and it is being introduced to some vehicle categories in compliance with regulations based on new long-term targets. It is hoped that purifying capacity and durability will improve in the future with the increasingly widespread use of diesel fuel with a sulfur content of 10 ppm or less, the further elaboration of control of NOx reduction, and other factors.

NOx adsorber catalysts too are to be introduced to some vehicle categories in compliance with regulations in accordance with new long-term targets. As described in Section 3.1, in response to the commencement in 2007 of regulations reducing the sulfur content of diesel fuel to 10 ppm or less, a reduction in the frequency of desulfurization control and rich spikes is hoped to minimize decline in fuel efficiency, and improve purifying performance and durability.

If it becomes possible to gain a clear picture of the quantity of ammonia emitted without being reacted at the catalyst and the NOx emitted from engines as a result of the commercialization of NOx sensors which are currently in the R&D process and sensors which detect ammonia used as a NOx reducing agent in Urea SCR, etc., then these NOx reduction catalysts may be expected to function even more effectively.

For the reasons outlined above, in setting Diesel 2009 Targets, based on the premise that NOx reduction catalysts are employed and improvements are made in their purifying performance and durability, the Committee concluded that dramatic reductions in NOx would be possible.

(Difficulties and Potential for Further Development of Motor Vehicle Emission Control Technologies for Heavy-Duty Vehicles)

However, it is a fact that NOx reduction catalysts have a large number of technological issues which remain to be resolved. For example, NOx reduction catalysts are unable to adequately purify NOx if the temperature of the gas emitted from the engine and the resultant catalyst temperature have not reached a certain level. In Japan the average vehicle speed is lower than in Europe and the United States, which prevents catalyst temperature from rising, so if the same catalysts are used, there is a tendency for the purifying performance of the catalysts to be poorer in Japan. This tendency becomes a significant problem for heavy-duty vehicles which have lower engine speeds and larger catalyst capacities, so hopes are held for the development of catalysts with outstanding NOx purifying performance at low temperatures, especially for heavy-duty vehicles.

Moreover, with regard to NOx adsorber catalysts, even if diesel fuel with a sulfur content of 10 ppm or less is used, it is necessary to improve durability with respect to sulfur poisoning and to further the response to decline in fuel efficiency caused by desulfurization control and rich spikes. In particular, further improvements to durability are desirable for the commercialization of this technology in heavy-duty vehicles which require durability for long-distance travel. For Urea SCR the provision of stations to supply urea is essential, and the wide-ranging provision of supply stations is necessary for the widespread use of this technology in heavy-duty vehicles other than trucks and buses for which fuel filling stations are virtually specified.

In addition, there are a large number of issues which must be resolved to reduce NOx emissions from heavy-duty vehicles, such as ensuring stable combustion when switching between normal combustion and homogeneous charge compression ignition which is being developed based on the premise of use mainly in low-load/low-revolution ranges, the ease of fitting exhaust after-treatment devices to tractors and the like, the response to the decline in fuel efficiency caused by a dramatic increase in EGR gas used especially in large engines, and the response to the decline in fuel efficiency caused by the additional supply of fuel to raise the temperature of NOx adsorber catalysts.

(Challenge Targets for Heavy-Duty Vehicles)

With regard to reduction of NOx emissions from heavy-duty vehicles, permissible limit target levels shall be set according to technology which is assumed to be able to be commercialized by 2009. However, as described above, there are a large number of technological issues which need to be resolved to enable further reductions in emissions. It is therefore deemed appropriate not to rely solely on these target levels, but at the same time to lay down challenge target levels based on the premise of technology for which a schedule of commercialization has necessarily been established at this stage, thereby promoting future technological development and further reductions in motor vehicle emissions.

Therefore, with regard to NOx target levels for heavy-duty vehicles, as described above, not only will “next-phase target levels” be set as target levels deemed achievable for the next-phase by the end of 2009 or the end of 2010, but at the same time “challenge target levels” (described in accordance with Appendix 1 on page 31) shall be indicated as higher, challenging future targets in the hope of further technological developments.

Of these, with regard to the "challenge targets," the state of technological development and the possibility of achieving the targets will be verified in around 2008, and target levels and the timetable for their achievement shall be set as necessary while taking into account improvements in the air environment, especially in major urban areas, the potential for environmental improvements by localized anti-pollution measures, and the relationship with measures to reduce carbon dioxide (CO_2), while monitoring improvements in fuel and lubricant quality. At the same time, a study should be carried out into the setting of, and indeed the need for, permissible limits for particle size and quality for fine particles and ultrafine particles and the like described in Section 2.2.2, which are in a trade-off relationship with NOx.

(Other Matters)
With regard to non-methane hydrocarbons (NMHC), emissions from diesel motor vehicles have already been dramatically reduced compared to emissions from other sources, while for CO the current level of air pollution is much lower than environmental quality standards, so for these substances targets will remain unchanged at the level of new long-term targets.

In the United States, based on the premise that diesel fuel with a sulfur content of 15 ppm or less will be introduced, a tightening of regulations which would reduce NOx and PM by approximately 90% from current U.S. regulation levels for diesel heavy-duty vehicles from 2007 to 2010, and technological verification is currently underway concerning the possibility of achieving this goal. In Europe, regulations for passenger cars from around 2010 (EURO5) and regulations for heavy-duty vehicles from around 2012 (EURO6) are being studied, and deliberations are currently underway concerning such matters as specific regulation levels.

At this point in time there are many elements of uncertainty concerning these regulations in Europe and the United States. In the United States in particular, at the actual operating stage of the regulations, it is conceivable that a flexible approach will be adopted, such as implementing regulations on the averaged motor vehicle emissions per vehicle, according to factors including the number of vehicles produced by the manufacturer. It is therefore necessary to monitor future developments in this area. However, the running environment and motor vehicle emission testing methods are different from those of Japan, so while a simple comparison is difficult, it can be said that Japan's Diesel 2009 Targets excluding challenge targets promote dramatic

reductions in NOx and PM, and even bearing in mind the proposed regulations for Europe and the United States, they will prompt automobile manufacturers to carry out technological development at the world's highest level.

3.3 Reduction Effect on Motor Vehicle Emissions

According to estimates by the Ministry of Environment, emissions of air pollutants from motor vehicles (excluding two-wheeled motor vehicles and special motor vehicles) nationwide in FY 2000 totaled approximately 79,000 tons of PM and approximately 670,000 tons of NOx. Of these figures, the percentage of diesel motor vehicle emissions was approximately 100% for PM at approximately 79,000 tons, and approximately 85% for NOx at approximately 570,000 tons. (The state of PM emissions from gasoline motor vehicles has not been adequately identified at this stage, so these emissions have not been included in calculations.)

Meanwhile, looking at total emissions including emissions from sources other than motor vehicles, such as factories (excluding natural sources of emissions), emissions in the Kanto Region (seven prefectures including Tokyo) in FY 2000 are estimated at approximately 35,000 tons for PM and approximately 450,000 tons for NOx.

Shown below are calculated reductions in motor vehicle emissions based on the implementation of regulations up to the new long-term gasoline and diesel targets, and the additional implementation of regulations in accordance with Diesel 2009 Targets laid down in this report, taking into account a variety of different assumptions.

(Effect of Reduction in Emissions, etc., from Motor Vehicles)

(1)-i The growth in motor vehicle traffic volume to FY 2015, the change in the composition of motor vehicle categories and the market penetration rate of vehicles complying with regulations up to the new long-term gasoline and diesel targets are estimated, and based on these assumptions, emissions from motor vehicles in FY 2010 and FY 2015 will be reduced from FY 2000 levels as follows:

(FY 2010)

- By approximately 77% for PM (from approximately 79,000 tons to approximately 18,000 tons)
- By approximately 41% for NOx (from approximately 670,000 tons to approximately 390,000 tons)

(FY 2015)

- By approximately 92% for PM (from approximately 79,000 tons to approximately 61,000 tons)
- By approximately 56% for NOx (from approximately 670,000 tons to approximately 290,000 tons)

Restricted to the Kanto Region (seven prefectures including Tokyo), total emissions including emissions from sources other than motor vehicles, such as factories (excluding natural sources of emissions), will be reduced as follows:

(FY 2010)
- By approximately 46% for PM (from approximately 35,000 tons to approximately 19,000 tons)
- By approximately 20% for NOx (from approximately 450,000 tons to approximately 360,000 tons)

(FY 2015)
- By approximately 52% for PM (from approximately 35,000 tons to approximately 17,000 tons)
- By approximately 25% for NOx (from approximately 450,000 tons to approximately 340,000 tons)

(1)-ii The growth in motor vehicle traffic volume, the change in the composition of vehicle categories, and the market penetration of vehicles complying with regulations to the new long-term gasoline and diesel targets as well as regulations based on the Diesel 2009 Targets (next-phase targets for NOx emissions from heavy-duty vehicles) are estimated, and based on these assumptions, emissions from motor vehicles will be further reduced by FY 2010 and FY 2015 from the situation in (1)-i as follows:

(FY 2010)
- By approximately 1% for PM (from approximately 18,100 tons to approximately 17,900 tons)
- By approximately 4% for NOx (from approximately 390,000 tons to approximately 380,000 tons)

(FY 2015)
- By approximately 15% for PM (from approximately 6,100 tons to approximately 5,200 tons)
- By approximately 28% for NOx (from approximately 290,000 tons to approximately 210,000 tons)

Restricted to the Kanto Region (seven prefectures including Tokyo), total emissions including emissions from sources other than motor vehicles, such as factories (excluding of natural sources of emissions), will be reduced as follows:

(FY 2010)

- By approximately 0.2% for PM (from approximately 18,730 tons to approximately 18,680 tons)
- By approximately 1% for NOx (from approximately 360,000 tons to approximately 356,000 tons)

(FY 2015)

- By approximately 1% for PM (from approximately 16,700 tons to approximately 16,500 tons)
- By approximately 6% for NOx (from approximately 340,000 tons to approximately 320,000 tons)

(2)-i Assuming that the motor vehicle traffic volume remains unchanged from FY 2000 onward and that all applicable motor vehicles are replaced by vehicles which comply with regulations in accordance with new long-term gasoline and diesel targets, emissions from motor vehicles will be reduced from FY 2000 levels as follows:

- By approximately 95% for PM (from approximately 79,000 tons to approximately 3,800 tons)
- By approximately 60% for NOx (from approximately 670,000 tons to approximately 270,000 tons)

(2)-ii Assuming that the motor vehicle traffic volume remains unchanged from FY 2000 onward and that all applicable vehicles are replaced by vehicles which comply with regulations in accordance with new long-term gasoline targets and Diesel 2009 Targets (next-phase targets and challenge targets for NOx emissions from heavy-duty vehicles), emissions from motor vehicles will be further reduced from the situation in (2)-i as follows:

- By approximately 63% for PM (from approximately 3,800 tons to approximately 1,400 tons)
- By approximately 62% for NOx for next-phase targets (approximately 270,000 tons to approximately 100,000 tons)

  By approximately 81% for challenge targets (from approximately 270,000 tons to approximately 51,000 tons)

As is evident from the above estimates, the effect of regulations in accordance with Diesel 2009 Targets will become apparent, albeit in a slight manner, in FY 2010, one year after their implementation, and around 2015 will be clearly revealed. Therefore, in order to ensure that environmental quality standards are achieved in FY 2010 and maintained in subsequent years, the implementation of regulations in accordance with Diesel 2009 Targets is deemed effective.

In addition, the fitting of diesel motor vehicles with DPFs in response to the dramatic tightening of regulations for PM is expected to reduce emissions of fine particles and ultrafine particles described in Section 2.2.2, which are thought to be strongly related to health impacts.

Estimates have also been made concerning the effect of motor vehicle emission regulations on the improvement of environmental concentration in JCAPII (Japan Clean Air Program II), a joint research effort between the automotive industry and the petroleum industry.

According to these estimates, among specified areas in accordance with the Automobile NOx/PM Law, air pollutants from motor vehicles in the Kanto Region are dramatically reduced by the introduction of regulations in line with new long-term targets. Compared to 2000 levels, by 2015 NOx is forecast to be reduced by 48% and SPM by 45% in terms of emissions from motor vehicles, while the average concentration within the region will be reduced by approximately 19% for NO_2 and by approximately 28% for SPM. (Note 4) (Note 5)

Moreover, if measures to dramatically reduce motor vehicle emissions which correspond to Diesel 2009 Targets are carried out, further reductions, mainly in NOx, may be expected. This is deemed to indicate that an effect can be obtained close to that if measures are taken to remove gasoline motor vehicles in use whose emissions dramatically exceed regulation levels due to poor maintenance and other factors, as proposed by JCAP.

In particular, the contribution rate of motor vehicle emissions to total emissions from all sources is expected to be dramatically reduced for SPM by 2015 due to the introduction of regulations based on new long-term targets, and for NOx, the implementation of regulations in accordance with new long-term targets and measures to dramatically reduce motor vehicle emissions corresponding to Diesel 2009 Targets

are expected to result in a further reduction in the contribution rate of motor vehicle emissions to total emissions. (Note 6)

Either way, if measures to dramatically reduce motor vehicle emissions which correspond to Diesel 2009 Targets are carried out, focusing on NOx, their effect is forecast to become evident around 2015 in terms of reduced total emissions and reduced concentrations of SPM and NO_2 in the atmosphere.

(Note 4) The future growth rate in traffic volume was estimated independently by JCAP based on population and economic growth, etc. from "Survey to estimate future motor vehicle traffic flow" (PEC-1999JC-26). Passenger car traffic is forecast to remain around the same, while truck traffic will fall slightly.

(Note 5) Emissions from sources other than motor vehicles used to calculate average concentrations were estimated independently by JCAP based on various statistical data. (PEC-2001JC-04)

(Note 6) Total emissions from all sources were estimated without including emission sources for which statistical data is unavailable. (For example, components of soil origin and the like other than dust blown up by passing motor vehicles. Advection of yellow sands is also excluded.)

(*) The Relationship between Air Pollutants and Motor Vehicle Emissions

- The reduction of PM emitted from motor vehicles is effective in reducing the concentration of SPM in the atmosphere and reducing the quantity of hazardous air pollutants such as aldehyde in PM, and there is a drastic need for measures to reduce PM emitted from motor vehicles.
- The reduction of NOx emitted from motor vehicles is effective in reducing the concentration of NO_2 in the atmosphere and reducing the concentrations of SPM and photochemical oxidants which are generated as secondary substances. It also contributes to controlling acid rain which is largely attributed to such substances as NOx and ozone, which is the main component of photochemical oxidants. There is therefore a drastic need for measures to reduce NOx emitted from motor vehicles, particularly from the perspective of reducing NO_2.
- The reduction of hydrocarbons (hereinafter referred to as "HC") emitted from motor vehicles is effective in reducing the concentration of SPM and photochemical oxidants in the atmosphere, reducing the concentration of NO_2 generated by reaction with nitrogen monoxide (NO), and reducing hazardous air pollutants. It also contributes to controlling acid rain which is largely attributed to such substances as NOx and ozone, which is the main component of

photochemical oxidants. There is therefore a drastic need for measures to reduce HC emitted from motor vehicles.

4. Measures to Reduce Emissions from Gasoline/LPG Motor Vehicles

4.1 Motor Vehicle Emission Control Technologies

In recent years, dramatic improvements have been made in motor vehicle emission control technologies for gasoline/LPG motor vehicles, especially passenger cars, focusing on improvements in the purifying performance and durability of catalysts, and increasing accuracy of controls with progress in electronic control technology.

In addition, while large numbers of motor vehicle categories have already been launched which meet new long-term targets, vehicles which have obtained certification as low-emission vehicles with emissions dramatically lower than regulation levels are becoming more widespread, and are forecast to become even more so in the future.

Moreover, the Fifth Report (Chukanshin No. 20, April 16, 2002) indicates that all passenger cars, mini-sized trucks, light-duty vehicles and medium-duty vehicles manufactured in 2008 and beyond should be fitted with advanced OBD systems, but due to independent initiatives of motor vehicle manufacturers, these systems seem likely be fitted to some vehicle categories from around 2006.

In this way, for gasoline/LPG motor vehicles, dramatic reductions in emissions are being achieved not only by the government's establishment of permissible limit target levels, but also through such factors as progress in technological development by motor vehicle manufacturers.

4.2 Permissible Limit Target Levels

As laid out in Section 4.1, it is deemed appropriate that new long-term targets remain unchanged for NOx, NMHC and CO, taking into account compliance with regulations based on new long-term gasoline targets, technological progress, and the effect of measures such as the certification system for low-emission vehicles.

However, among gasoline/LPG motor vehicles, in lean-burn direct injection vehicles it is sometimes the case that unburned fuel is emitted as PM due to inadequate vaporization of fuel in the combustion chamber and rich spikes in the NOx adsorber

catalysts fitted to said vehicles. As a result, in some vehicle categories, PM is emitted at a level similar to or greater than diesel motor vehicles fitted with DPFs.

It is therefore appropriate, for lean-burn direct injection vehicles alone, to set permissible limit target levels for PM at the same levels as for diesel motor vehicles. Based on this line of thinking, the conclusion was reached that it is appropriate to reduce PM in line with the permissible limit target levels for emissions (hereinafter referred to as "Gasoline 2009 Targets") shown in Appendix 2 (see page 32) by the end of 2009.

With regard to vehicles with gasoline direct injection engines (hereinafter referred to as "stoichiometric direct injection vehicles") not fitted with NOx adsorber catalysts, at this stage there is no data indicating that PM emissions account for a large percentage of emissions from such vehicles, so it is appropriate not to establish permissible limits for PM.

With regard to NOx and other motor vehicle emission components, if, for example, the market penetration of certified low-emission vehicles falls dramatically below current levels and the effectiveness of the low-emission vehicle certification system weakens, or other changes in the situation occur, the setting of these permissible limit target levels shall be studied again as necessary.

5. International Harmonization of Standards

In order to effectively promote improvements in air pollution caused by motor vehicles, it is necessary to appropriately evaluate the reduction effect in motor vehicle emissions in Japan by accurately reflecting the running conditions and forms of use, etc. in regulations. Meanwhile, because many measures to reduce motor vehicle emissions are common to Japan and other countries, and because motor vehicles are products which are distributed internationally, based on the purpose of the Agreement on Technical Barriers to Trade which came into effect on January 1, 1995, the objective of which is to ensure that standard certification systems do not generate unnecessary obstacles to international trade, it is desirable that international harmonization of standards be promoted wherever possible within a scope which does not hinder Japan's environmental preservation.

Therefore an active contribution should be made to the international harmonization of standards for emission testing methods for large trucks, OBD systems, measures for

controlling off-cycle emissions, and emission testing methods for two-wheeled motor vehicles, among others, which are currently underway at UN-ECE/WP29, and efforts should be made to promote international harmonization of standards to the greatest degree possible.

Of these, for heavy-duty vehicles, it is desirable that the progress in international developments to harmonize standards be taken into account, at least in examining the challenge targets and their timetable for achievement for heavy-duty vehicles laid down in Section 3.2.

International harmonization of standards also offers the following advantages:

- For motor vehicle manufacturers, promotion of technological development by more efficient research and development, and reduced development and production costs through sharing of parts.
- Reduced purchase prices for motor vehicle users.

6. Future Measures to Reduce Motor Vehicle Emissions

In order to largely attain environmental quality standards by 2010 and ensure that they are maintained in subsequent years, it is necessary to effectively implement regulations in accordance with Diesel 2009 Targets and Gasoline 2009 Targets laid down in Sections 3.2 and 4.1. At the same time it is also necessary to study issues concerning challenge target levels for heavy-duty vehicles discussed in Section 3.2, and to promote further study of the variety of technological issues for which conclusions have not been reached, as set forth in Section 6.1.

Moreover, if improvements are to be made to the air environment, especially in major urban areas, and residents are to enjoy a good living environment, not only motor vehicle emission regulations, but also various air pollution control measures and related policies will need to be promoted in the future, and the issues to be addressed in doing so are set forth in Section 6.2.

6.1 Future Issues to Be Studied

(1) With regard to diesel motor vehicles, the setting of new permissible limit target levels should be studied as necessary while monitoring compliance with regulations in accordance with Diesel 2009 targets, the potential for technological development, the improvement in the air environment with a view to achieving environmental quality standards for the air environment in FY 2010, the outlook for subsequent

improvements due to regulations in accordance with Diesel 2009 Targets, the actual state of emissions from sources other than motor vehicles, and the effect of comprehensive measures such as motor vehicle traffic flow measures, while giving maximum consideration to the compatibility of fuel-efficiency technology and motor vehicle emission reduction technologies. This should include a study of measures to address fuel and lubricant quality based on research into the effect of a combination of reformulating fuels and lubricants and improvements in motor vehicle technology in reducing motor vehicle emissions conducted under the cooperation of the government, motor vehicle manufacturers, fuel producers, and others.

(2) With regard to gasoline/LPG motor vehicles, the setting of new permissible limit target levels should be studied as necessary while monitoring progress in compliance with regulations in line with new long-term gasoline targets and Gasoline 2009 Targets, the take-up of low-pollution vehicles with emissions dramatically lower than these regulations, the potential for technological development, and the improvement in the air environment with a view to achieving environmental quality standards for the air environment in FY 2010, an assessment of the state of emissions from emissions sources other than motor vehicles, and the comprehensive effect of a variety of measures such as traffic control measures, while giving maximum consideration to the compatibility of fuel-efficiency technology and motor vehicle emission control technologies.

In addition, with regard to measures to reduce evaporative emissions when filling vehicles with fuel, the introduction of regulations will be examined as necessary based on the degree of contribution to overall emissions of hydrocarbons (hereinafter referred to as "HC") and the progress in HC measures for other emission sources.

(3) Regarding special diesel motor vehicles with rated engine outputs ranging from 19 kW up to but not including 560 kW, the feasibility of adapting the after-treatment devices used by conventional diesel motor vehicles in order to satisfy regulations in accordance with the new long-term targets will be determined and the setting of new permissible limit target levels designed to be met by around 2010 will be studied. At the same time, the introduction of new emission testing methods will also be studied.

(4) Regarding special gasoline/LPG motor vehicles with rated engine outputs ranging from 19 kW up to but not including 560 kW, monitoring will be conducted of compliance with regulations instituted on the basis of the Sixth Report (Chukanshin No. 126, June 30, 2003), the potential for further technological development, and the efficacy of various types of measures and new permissible limit target levels will be considered as necessary. The introduction of new emission testing methods will also be studied in the same way as for special diesel motor vehicles.

(5) There are currently no permissible limits for emissions from special motor vehicles with rated engine outputs below 19 kW or those of 560 kW or more, or for general-purpose engines other than special motor vehicles. For these categories, certification is being carried out for engines with a rated output of 8 kW or more but less than 19 kW and general-purpose engines other than special motor vehicles in accordance with the Land, Infrastructure and Transport Ministry's Designation System for Emission Control Type Construction Machinery. The introduction of emission regulations for these categories will be studied as necessary while monitoring such developments as the effect of this system and the state of implementation of voluntary initiatives concerning general-purpose diesel engines with a rated output below 19 kW which will be implemented from 2006 by the Japan Land Engine Manufacturers Association as a voluntary regulation by industry, the state of air pollution, these engines' contribution to total emissions, and the progress of emission control technologies.

(6) Regarding two-wheeled motor vehicles, monitoring will be conducted of the response to regulations based on the permissible limit target levels recommended in the Sixth Report, the potential for further technological development, and the efficacy of various types of measures and new permissible limit target levels will be considered as needed. At the same time, the introduction of new motor vehicle emission testing methods and the setting of new permissible limits for evaporative emissions will be studied.

(7) Of the biomass fuels, for which there have been high expectations in recent years from the perspective of preventing global warming, the potential for usage of E10 (fuel in which bioethanol has been added up to 10% by volume to gasoline) will be reviewed in the future as necessary, taking into account the state of motor vehicle technological development supporting this fuel (including technologically advanced

measures which satisfy motor vehicle emission regulations based on the premise of conventional gasoline engines) and the supply framework for E10. In addition, new fuels such as gas-to-liquid (GTL), dimethyl ether (DME) and ethyl tertiary butyl ether (ETBE) should be examined as necessary, based on market developments.

6.2 Future Issues to Be Addressed concerning Related Measures

As policies to complement the measures set forth in this report, the related measures discussed below should be promoted to a greater extent in the future.

(1) Promotion of Comprehensive Measures to Reduce Motor Vehicle Emissions Such as Policies in Accordance with the Automobile NOx/PM Law

(i) As the areas in which environmental quality standards have not been achieved become localized, uniform nationwide emission regulations on new vehicles gradually become less effective from a cost-benefit perspective as well. Therefore, based on the premise that regulations will be implemented in accordance with the Diesel 2009 Targets and Gasoline 2009 Targets, it will become increasingly meaningful to implement special measures in regions where air pollution is relatively severe. Therefore, in addition to steadily implementing controls by category of motor vehicles in accordance with the Automobile NOx/PM Law, comprehensive measures such as the enhancement of measures to suppress motor vehicle emissions generated by businesses and the promotion of low-pollution vehicles should be taken, and the efficacy of these measures should be studied.

With a view to complementing the various policies in accordance with the Automobile NOx/PM Law, it is desirable that effective measures be actively studied and implemented to suppress motor vehicle emissions, such as facilitating the flow of traffic, suppressing traffic volume, and improving road structure and urban structure.

(ii) With regard to vehicles in use in general (gasoline/LPG motor vehicles and diesel motor vehicles in use, etc.), in the future it is important that good emission performance of vehicles in use be maintained by enforcing inspections and maintenance, and by verifying the performance of motor vehicle emission control devices when controlling and providing guidance on the roadside and in vehicle inspections in accordance with the Road Trucking Vehicle Law (Law No. 185 of 1951). With regard to diesel motor vehicles in particular, with the tightening of motor vehicle emission regulations, the use of exhaust after-

treatment devices such as DPF and NOx reduction catalysts will become more widespread, so it is necessary that the performance of these exhaust after-treatment devices is maintained in vehicles that are in use. Measures to maintain the emissions performance of vehicles in use will therefore take on increasing importance.

It is therefore desirable that comprehensive measures concerning vehicles in use, such as setting motor vehicle emission levels concerning vehicles in use and policies for the introduction of surveillance, be examined as soon as possible, including the need for such measures.

(iii) In addition to fuel-efficiency measures, "idle-stop" is effective in terms of reducing motor vehicle emissions, therefore efforts should be made to promote idle-stop, such as promoting the widespread use of motor vehicles equipped with an idle-stop function.

(2) Status Surveys and Improvements to Measurement Accuracy

With the progress in motor vehicle emission regulations and comprehensive measures to reduce motor vehicle emissions, it becomes increasingly important, in terms of planning and implementing new measures, to accurately forecast the effect of these measures and to accurately measure their effect through accurate monitoring. At the same time, it is necessary to gain a clear picture of the contribution to the formation of secondary pollutants such as SPM and photochemical oxidants, and to put in place an emissions inventory of PM, NOx, and other substances emitted from all emission sources including motor vehicles, stationary sources such as factories and work sites, and various natural sources. Efforts must therefore be made, for example, to establish systems to assess the impact of measures for different types of emission sources and measures in roadside and other locations in improving the air environment.

(3) Measures for Unregulated Pollutants

(i) With regard to unregulated hazardous air pollutants emitted from motor vehicles, efforts must be made to develop measurement methods and to improve measurement accuracy, to put in place infrastructure to gain a clear picture of the quantity of emissions from motor vehicles, and to work to implement necessary measures based on the information obtained. In this process, it is also desirable to work to gain a clear picture of the impact of such factors as engine combustion technology, catalysts and other exhaust after-treatment devices, and

fuel and lubricant quality on the quantity of hazardous air pollutants emitted from motor vehicles.

(ii) With regard to unregulated emission sources other than motor vehicles, it is desirable to continue surveying the state of emissions and examining the need for measures, and to study the blueprint for a system to implement such measures.

(4) Financial and Tax Incentives

In the process of promoting the measures to reduce motor vehicle emissions based on this report, it is conceivable that vehicle prices, fuel efficiency, and maintenance costs may be affected. Based on the principle of internalizing environmental costs resulting from the use of motor vehicles, these expenses should be borne by the motor vehicle manufacturers and users. It will therefore be necessary to put in place financial and tax incentives to ensure that both reformulation of fuel and the replacement of old vehicles by new ones in compliance with the latest regulations proceed smoothly. It is hoped that efforts will be made toward the establishment of such incentives.

Reference: Background to Motor Vehicle Emission Control in Japan and Background to Discussions Held by the Central Environment Council

(1) Background to Motor Vehicle Emission Control in Japan

Motor vehicle emission control in Japan began in 1966 with the adoption of regulations limiting the concentration of carbon monoxide (CO) in emissions from ordinary-sized motor vehicles and small-sized motor vehicles (excluding two-wheeled motor vehicles) using gasoline for fuel. Subsequently, regulations were added for mini-sized motor vehicles and vehicles using LPG for fuel (excluding two-wheeled motor vehicles and special motor vehicles), as well as diesel motor vehicles, two-wheeled motor vehicles and special motor vehicles. The regulated substances were gradually expanded to include NOx, and PM, among others. Meanwhile, due to the fact that fuel quality has a large impact on motor vehicle emissions, the Air Pollution Control Law was amended, and fuel quality was regulated from 1996.

As a result of the enhancement and tightening of motor vehicle emission regulations in Japan based on the long background described above, looking at the regulations in accordance with the most recent new long-term targets which are to start in 2005, the

level of regulations was amongst the world's most rigorous at the time of their application.

However, as described in Section 1, the implementation of regulations based on new long-term targets alone is inadequate if environmental quality standards relating to NO_2 and SPM are to be achieved in FY 2010 and maintained in subsequent years. The Experts Committee has therefore studied a further tightening of permissible limit target levels in accordance with the Seventh Report.

(2) Background to Discussions Held by the Central Environment Council

The Ministry of the Environment (the Environment Agency up to 2000), with the results of expert discussions in the Central Environment Council (the Central Council for Environmental Pollution Control up to 1993), is implementing measures to reduce motor vehicle emissions such as the motor vehicle emission regulations set forth in (1) above.

Recent measures for reducing motor vehicle emissions have been implemented in keeping with the targets recommended in a report issued in December 1989 by the Central Council for Environmental Pollution Control (Chukoshin), entitled Future Policy for Motor Vehicle Emission Reduction (Chukoshin No. 266, December 22, 1989; hereinafter referred to as the "1989 Report"). By 1999, the government had adopted all measures recommended in the report, which included regulations designed to accomplish the following:

- Achieve major reductions in NOx, PM, and other emissions from diesel motor vehicles, etc., in two stages through short- and long-term targets.
- Reduce the sulfur content in diesel fuel to approximately one-tenth of current levels in two stages through short- and long-term targets (from 0.5 mass % to 0.2 mass % and finally to 0.05 mass %).

In May 1996, with the nation on track to achieve all the permissible limit target levels indicated in the 1989 Report, and the need to continue to tighten measures to reduce motor vehicle emissions, the Director-General of the Environment Agency sent a request to the Central Environment Council to formulate recommendations for Future Policy for Motor Vehicle Emission Reduction (Inquiry No. 31, May 21, 1996). In response, deliberations were begun within the Air Quality Committee of the Central Environment Council, as well as this Experts Committee on Motor Vehicle Emissions newly established under the Air Quality Committee.

In response to this inquiry, the Central Environment Council compiled the Interim Report (Chukanshin No. 83, October 18, 1996), the Second Report (Chukanshin No. 120, November 21, 1997), the Third Report (Chukanshin No. 144, December 14, 1998), the Fourth Report (Chukanshin No. 193, November 1, 2000), the Fifth Report, Sixth Report, and Seventh Report.

Of these reports, the Second to the Fifth Reports set down two-stage permissible limit target levels that have been established for gasoline/LPG motor vehicles and diesel motor vehicles in the form of new short-term targets and new long-term targets.

These new short-term targets for gasoline/LPG motor vehicles cut emissions of NOx and HC by approximately 70% (approximately 50% for mini-sized trucks) depending on vehicle category compared to long-term targets for gasoline/LPG motor vehicles from 2000 to 2002, and the new short-term targets for diesel motor vehicles reduce emissions of PM and NOx by approximately 30% depending on vehicle category compared to long-term targets for diesel motor vehicles from 2002 to 2004.

The new long-term targets for gasoline/LPG motor vehicles reduce NOx emissions between 50% to 70% and HC emissions by 63% to 77% compared to new short-term gasoline targets by 2005 (2007 for mini-sized trucks), with the aim of tightening NOx and HC regulations, while giving due consideration to measures to reduce CO_2.

The new long-term targets for diesel motor vehicles assign priority to reducing PM, and reduce PM emissions by 75% to 85% and NOx emissions by 41% to 50% compared to new short-term targets for diesel motor vehicles by 2005. As at 2005 they are the most rigorous in the world.

In order to achieve these new long-term targets, the Fourth Report recommended that sulfur content of gasoline and diesel fuel be reduced to 50 ppm or less by the end of 2004, and the Seventh Report indicated that sulfur content of diesel fuel be reduced to 10 ppm or less from 2007 in order to promote technological development relating to measures to reduce motor vehicle emissions beyond the new long-term targets.

In addition, the Fifth Report recommended that changes be made to testing modes in stages from 2005 to 2011 in order to evaluate motor vehicle emission performance with a greater degree of accuracy. With regard to these changes, the government has

adopted the necessary measures for the majority of items through revisions of motor vehicle emission permissible limits and others, with some already having been implemented.

With regard to two-wheeled motor vehicles, motor vehicle emission regulations were carried out from 1998 to 1999 according to vehicle category based on the Interim Report. Furthermore, the Sixth Report recommended that HC be reduced by 75% to 85%, NOx by 50%, and CO by 85% compared to existing regulation levels from 2006 to 2007.

With regard to diesel special motor vehicles, motor vehicle emission regulations were implemented from 2003 based on the Second Report and the Fourth Report, and the Sixth Report recommended that PM and NOx be reduced by between 20% and 50% compared to existing regulation levels from 2006 to 2008. It also recommended the introduction of regulations for gasoline/LPG special motor vehicles from 2007.

This report was studied in a bid to constitute the Eighth Report in response to the 1996 inquiry.

Appendix 1

Permissible Limit Target Levels for Diesel Motor Vehicle Emissions (Diesel 2009 Targets)

Motor vehicle category		Permissible limit target level for emissions (average level)			
		Nitrogen oxides	Non-methane hydrocarbons	Carbon monoxide	Particulate matter
Diesel fuel-powered ordinary-sized motor vehicles and small-sized motor vehicles exclusively for passenger use, with a capacity not exceeding 10 persons (excluding two-wheeled motor vehicles)		0.08g/km	0.024g/km	0.63g/km	0.005g/km
Diesel fuel-powered ordinary-sized motor vehicles and small-sized motor vehicles (excluding vehicles exclusively for passenger use with a capacity not exceeding 10 persons and two-wheeled motor vehicles)					
	Vehicles with a gross vehicle weight not exceeding 1,700 kg	0.08g/km	0.024g/km	0.63g/km	0.005g/km
	Vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg	0.15g/km	0.024g/km	0.63g/km	0.007g/km
	Vehicles with a gross vehicle weight exceeding 3,500 kg	0.7g/kWh (Next-phase target level) Approximately one-third of 0.7g/kWh (Challenge target level)	0.17g/kWh	2.22g/kWh	0.01g/kWh

* Underlined target levels are permissible limit target levels whose numerical values have changed since the new long-term targets for diesel motor vehicles.

* With regard to permissible limit target levels for vehicles having a gross vehicle weight not exceeding 3,500 kg, from 2008 levels will be calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the 10/15 mode measurement value by 0.75, while from 2011 onward the value applied will be the value calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the value measured while warm using the new testing mode by 0.75.

* With regard to challenge target levels, after verifying values in around 2008, target levels and the timetable for achievement should be finalized as necessary.

Appendix 2

Permissible Limit Target Levels for Gasoline/LPG Motor Vehicle Emissions

(Gasoline 2009 Targets)

Motor vehicle category	Permissible limit target level for emissions (average level)			
	Nitrogen oxides	Non-methane hydrocarbons	Carbon monoxide	Particulate matter (Note)
Gasoline- or LPG-powered ordinary-sized, small-sized and mini-sized vehicles, exclusively for passenger use, with a capacity not exceeding 10 persons (excluding two-wheeled motor vehicles)	0.05g/km	0.05g/km	1.15g/km	<u>0.005g/km</u>
Gasoline- or LPG-powered mini-sized vehicles (excluding vehicles exclusively for passenger use, vehicles equipped with two-stroke engines and two-wheeled motor vehicles)	0.05g/km	0.05g/km	4.02g/km	<u>0.005g/km</u>
Gasoline- or LPG-powered ordinary-sized and small-sized vehicles (excluding vehicles exclusively for passenger use with a capacity not exceeding 10 persons, and two-wheeled motor vehicles)				
Vehicles with a gross vehicle weight not exceeding 1,700 kg	0.05g/km	0.05g/km	1.15g/km	<u>0.005g/km</u>
Vehicles with a gross vehicle weight exceeding 1,700 kg but not exceeding 3,500 kg	0.07g/km	0.05g/km	2.55g/km	<u>0.007g/km</u>
Vehicles with a gross vehicle weight exceeding 3,500 kg	0.7g/kWh	0.23g/kWh	16.0g/kWh	<u>0.01g/kWh</u>

* Underlined target levels are permissible limit target levels whose numerical values have changed since the new long-term targets for gasoline/LPG motor vehicles.

* With regard to permissible limit target levels for vehicles having a gross vehicle weight not exceeding 3,500 kg, from 2008 levels will be calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the 10/15 mode measurement value by 0.75, while from 2011 onward the value applied will be the value calculated by adding the value obtained by multiplying the value measured while cold using the new testing mode by 0.25 to the value obtained by multiplying the value measured while warm using the new testing mode by 0.75.

(Note) Permissible limit target levels for particulate matter are only applied to lean-burn direct injection vehicles fitted with NOx adsorber catalysts.

Roster of the Experts Committee on Motor Vehicle Emissions

(Part of the Air Environment Committee of the Central Environment Council)

Member Status	Name	Affiliation	Remarks
Chairman Special member	○ Michikata Kono	Dean of the Graduate School of Frontier Sciences, University of Tokyo	
Special member	Kazuhiko Sakamoto	Professor, Graduate School of Science and Engineering, Saitama University	
Special member	○ Yasuhiro Daisho	Professor, School of Science and Engineering, Waseda University	
Expert member	Takashi Ibusuki	Director, Institute for Environmental Management Technology, National Institute of Advanced Industrial Science and Technology (AIST)	Resigned in March 2004
Expert member	Masakazu Iwamoto	Professor, Chemical Resources Laboratory, Tokyo Institute of Technology	
Expert member	○ Matsuo Odaka	Former Executive Director, National Traffic Safety and Environment Laboratory	
Expert member	Takeshi Saito	Director, Traffic Department, National Research Institute of Police Science, National Police Agency	
Expert member	○ Masahiro Shioji	Professor, Graduate School of Energy Science, Kyoto University	
Expert member	Hiroyasu Nagae	Professor emeritus, Nihon University	
Expert member	○ Akira Noda	Executive Director, National Traffic Safety and Environment Laboratory	Appointed to committee in August 2004
Expert member	Yasuhiro Fukuma	Director, Japan Automobile Research Institute	
Expert member	Hidetsuru Matsushita	Professor emeritus, University of Shizuoka	
Expert member	Tateki Mizuno	Director, Joint Research Center for Advanced Diesel Engine System, National Institute of Advanced Industrial Science and Technology	Appointed to committee in April 2004
Expert member	Makoto Misono	Professor, Department of Environmental Chemical Engineering, Kogakuin University	

Note:People with a circle next to their name are committee members who have also belonged to the working committee which has drafted this report and others under the Experts Committee.

Glossary

Acetaldehyde

A transparent flammable liquid with an irritating odor. Generated by direct oxidation of ethylene.

Air toxics/hazardous air pollutants

Air pollutants that pose a risk to human health when inhaled continuously. Under the Air Pollution Control Law, emissions of such air toxics as benzene are controlled through monitoring of air quality and businesses' voluntary management plans.

Ammonia sensor

A sensor which detects the ammonia concentration after addition of urea.

Automobile NOx/PM Law

Abbreviation for the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas (Law No. 70, 1992). A partial amendment carried out in June 2001 to expand the applicable substances, etc. of the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides from Automobiles in Specified Areas enacted in June 1992.

This law stipulates the following: (1) that areas suffering severe air pollution by NOx and PM emitted from motor vehicles shall be designated as areas requiring special measures, (2) in accordance with the basic policy formulated by the government, the prefectural governor of areas requiring special measures shall formulate a plan to reduce overall emissions, and promote measures in a comprehensive and planned manner, (3) special emission standards for NOx and PM shall be applied, restricting motor vehicles which can be owned and used within areas requiring special measures, (4) specific enterprises whose use of motor vehicles exceeds a predetermined limit shall be bound to submit plans to suppress emissions and to report on the implementation of such plans.

Under this law, environmental quality standards for air pollution by NO_2 and SPM in areas requiring special measures should be roughly achieved by FY 2010.

Benzene

A transparent volatile liquid. It is the simplest aromatic hydrocarbon. It is used as a substrate for aromatic compounds as a raw material in synthesizing organic compounds.

Bioethanol

Ethanol refined from biomass such as sugar cane or thinned wood with the objective of being added to gasoline. The CO_2 generated from the combustion of bioethanol is not included in CO_2 emissions under the Kyoto Protocol.

Cetane number

A number which indicates ignition properties of fuel related to diesel knock (the combustion noise caused by delayed timing of the self-ignition of fuel) in compression ignition engines. The larger the number, the higher the anti-knock properties.

De-NOx catalyst

A catalyst which functions by reducing nitrogen oxides, returning them into nitrogen and oxygen molecules. There are two types: one in which NOx is adsorbed into an adsorber, and reduction is carried out by controlling the air/fuel ratio, and another in which reduction is carried out by adding urea as a reducing agent.

DME (dimethyl ether)

An ether produced from natural gas or coal gas, used primarily as a spray propellant. It has recently come under study as a possible substitute for diesel oil.

DPF (diesel particulate filter)

A filter which, when installed in the exhaust system, traps the particulate matter in motor vehicle exhaust and removes it with a heating element or catalyst. Those using catalysts are called “continuously regenerating DPFs.”

EGR (exhaust gas recirculation)

The mixture of a certain amount of exhaust gas with the intake air to inhibit the formation of nitrogen oxides. The effect is due to a drop in combustion temperature.

ETBE (ethyl tertiary butyl ether)

An ether produced from ethanol and isobutene. As an oxygenate, it has high octane and is used in France and elsewhere as an additive to raise gasoline octane. Can also be manufactured from bioethanol.

FAME (fatty acid methyl esters)

A substance produced by combining adding methanol to vegetable oils, recycled cooking oil, etc. in the presence of a base catalyst to produce an ester, from which glycerol is then removed to lower viscosity.

Fine particles

The collective name for particles with a particle diameter of 2.5 microns or less. These particles pass through the windpipe and are deposited in the lungs, where they may have a harmful effect on the body.

Gasoline direct injection engine

In contrast to conventional engine configurations which introduce a mixture of gasoline and air into the cylinder where combustion takes place, in this type of engine gasoline is directly injected into the engine and combusted with air which has already been introduced into the cylinder.

GTL (gas-to-liquid fuel)

A petroleum-like fuel synthesized from natural gas, coal gas, etc. Containing virtually no sulfur or aromatic hydrocarbons and easier to transport and handle than gas, GTL has come to be regarded as a promising alternative fuel in recent years.

Homogeneous charge compression ignition

A technology wherein fuel is injected partway through compression in a diesel engine, and self-ignited after fuel and air have been mixed adequately. It is hoped to reduce NOx and PM.

Idle-stop

The practice of or a mechanism for turning off the engine when the vehicle is stopped.

JE05 Mode

The abbreviated name for the engine-based motor vehicle emission testing method which is to be introduced in conjunction with the regulations based on new long-term targets. A testing mode which converts a typical running mode based on actual running conditions into figures which correspond to the engine speed and load of individual engines. In order that the engine speed and load of individual engines are accurately reflected, this conversion is calculated from the engine and vehicle specifications as well as the gear position and number of gears.

Lean-burn engine

An engine that uses a special technology to maintain steady combustion while using as lean as possible a mixture of gasoline and air. While a high air/fuel ratio normally causes unstable combustion, a lean-burn engine makes use of intake ports that create a swirl of intake air, thus stabilizing combustion.

LPG (liquefied petroleum gas)

A blend of gases, such as propane and butane, liquefied under pressure at ordinary temperatures.

Motor vehicle emissions

Substances, generated by the operation of motor vehicles, that pose a risk to human health or the living environment and are designated as such under the Air Pollution Control Law. Included are carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter. In addition to substances emitted from the exhaust pipes (referred to as exhaust emissions), emissions include evaporative gases and blow-by gases (gases leaked from cylinder walls inside an engine).

NOx sensor

A sensor which detects the concentration of nitrogen oxides in emissions, and converts this into an electric signal. Used to monitor deterioration in performance of emission control devices.

OBD system (onboard diagnostic system)

A system installed in a motor vehicle for detecting and diagnosing malfunctions or breakdowns.

Octane number

An indicator of the anti-knock properties of a fuel in spark ignition engines. The higher the octane number, the higher anti-knocking properties are. Octane can be expressed in terms of either research octane number (RON), which refers to anti-knock properties at low speeds, or motor octane number (MON), which indicates anti-knock properties at high speeds. Under Japanese standards, octane is defined as RON.

Off-cycle measures

Under running conditions other than motor vehicle emission testing methods stipulated by legislation (off-cycle), there is a danger that emissions dramatically exceeding regulation levels may be emitted from motor vehicles. This term is therefore used to

refer to measures to reduce emissions of motor vehicles under off-cycle conditions.

Photochemical oxidant

Oxidizing substances such as ozone which are generated by photochemical reactions between NOx and HC.

PM (particulate matter)

PM emissions from motor vehicles are classified as either black smoke, sulfates, or soluble organic fraction (SOF). Sulfates—sulfur compounds formed by the oxidation of sulfur in the fuel—are generated in large quantities when engine load is high or when a powerful oxidation catalyst is used. SOF is formed from unburned diesel fuel and lubricants and consists of organic compounds with a low boiling point that can be removed by solvent extraction.

SPM (suspended particulate matter)

Collective term for particles 10 microns or less in diameter that float in the atmosphere; they are subject to environmental quality standards. SPM is divided into primary particles, or those emitted directly from the source, and secondary particles, which are formed by chemical reactions or condensation of gaseous emissions.

Sulfate

The collective term for sulfate compounds generated by the oxidation of the sulfur component in fuel. Large quantities of sulfates are generated when engines are operated under high loads and when there are catalysts with high oxidizing capacities.

Surveillance

Surveillance as a measure to maintain emissions performance in vehicles in use means arbitrarily selecting vehicles from the market for sample test.

Ultra-fine particles

The collective name for particles with a particle diameter in the nanometer range. Commonly referred to as “nano-particles.” Without stopping at the lungs, these particles enter the blood vessels from the lungs, and through the blood vessels may have harmful effects on the whole body.

UN-ECE/WP29 (United Nations Economic Commission for Europe/Working Party 29)

Abbreviation for the World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe. As an organization under the control of the ECE, it makes final decisions concerning standardized vehicle regulations for Europe (ECE regulations).

Urea SCR (urea selective catalytic reduction)

A catalyst system which reduces NOx to N_2 using ammonia generated by added urea as a reducing agent.

VOC (volatile organic compound)

The collective term for volatile organic compounds. Deemed to be the cause of secondary particles of photochemical oxidants and suspended particulate matter (SPM).

Sources: Society of Automotive Engineers of Japan, *Japanese-English Dictionary for Automobiles* (Tokyo, 1997) and others.

Overview of
"Future Policy for Motor Vehicle Emission Reduction (Eighth Report)" of the Central Environment Council

I. Measures to Reduce Emissions from Diesel Motor Vehicles (2009 Targets)

(Overview)

- Japan's levels of air pollution by suspended particulate matter (SPM), nitrogen dioxide (NO_2), etc. remain high.
- Therefore, based on the premise of the introduction of diesel fuel with a sulfur content of 10 ppm or less, the introduction of exhaust after-treatment devices for nitrogen oxides (NOx), as well as of DPF (diesel particulate filters) will be promoted in a bid to dramatically reduce motor vehicle emissions.

(Targets)

- In a bid to dramatically reduce particulate matter (PM) and NOx, emissions regulations basically on a par with those for gasoline motor vehicles will be implemented (regulations for passenger cars and light and medium-duty motor vehicles may differ somewhat for particular substances).
- In particular, for PM, which is the focus of attention in terms of environmental measures for major cities, based on the premise of progress in DPF technology, efforts will be made to strive toward a so-called "PM-free" environment with levels below the quantitation limits using existing measurement methods. The same level of PM regulations shall also be implemented on some gasoline motor vehicles (*).

  * Vehicles fitted with lean-burn direct injection gasoline engines
- With regard to NOx, for heavy-duty vehicles (with a gross vehicle weight exceeding 3.5 tons), the world's most rigorous target levels will be set for 2009. Not only that, but two-stage targets will be set which anticipate future progress in technological development. (These are referred to as "next-phase targets" and "challenge targets".)

(Timetable)

- As a rule, targets should be achieved by the end of 2009.
- However, targets for vehicles with a gross vehicle weight exceeding 1.7 tons but not exceeding 2.5 tons, and buses and trucks with a gross vehicle weight exceeding 3.5 tons but not exceeding 12 tons, should be achieved by the end of 2010.
- With regard to "challenge targets," technological review shall be carried out in around 2008, and target values and their timetable for achievement should be finalized as necessary.

Note: In the course of the aforementioned technological review, the relationship with the state of improvement to the air environment, CO_2 reduction measures, etc. will be closely analyzed.

II. Measures to Reduce Emissions from Gasoline Motor Vehicles (2009 Targets)

(Overview)

- For some vehicles(*), about which fears are held concerning PM emissions, the same level of PM regulations will be implemented as for diesel motor vehicles.
- These targets should be achieved by the end of 2009.

  * Vehicles fitted with lean-burn direct injection gasoline engines

III. PM Measurement Methods

- In response to the dramatic tightening of PM regulations, methods to measure PM in a more stable manner will be developed in time for 2009 regulations.
- Government, industry, and academia shall band together to carry out research into methods to measure not only the quantity but also the quality (number of particles, etc.) of PM.

IV. Other Matters

- Further review is required concerning advanced onboard diagnostic (OBD) systems for diesel motor vehicles, including the content of such systems.
- With the increasingly widespread use of exhaust after-treatment devices for diesel motor vehicles, measures to maintain the function of such devices in vehicles that are in use become important, and further review of this matter is required, including the implementation scheme for such measures.

(Significance of This Report)

- If 2009 targets for diesel and gasoline motor vehicles are implemented and widely adopted, it is predicted that the NOx and PM emitted from motor vehicles will be reduced dramatically, and the impact of motor vehicle emissions on the atmosphere will be very limited.
- The implementation of these 2009 targets (excluding challenge targets) will make Japan's regulations among the most rigorous in the world in 2009-2010.

2009 Targets for Diesel Motor Vehicles and Gasoline Motor Vehicles

Note 1: Target units: g/kWh (heavy-duty vehicles), g/km (vehicles other than heavy-duty vehicles)

Note 2: GVW: gross vehicle weight, NMHC: non-methane hydrocarbons

Diesel Motor Vehicles

		PM	NOx	NMHC	CO	Timetable (reference)
Passenger cars		0.005 -62%	0.08 -43%	0.024 0%	0.63 0%	2009
Trucks/buses	Light-duty vehicles (GVW not exceeding 1.7 tons)	0.005 -62%	0.08 -43%	0.024 0%	0.63 0%	2009
	Medium-duty vehicles (GVW exceeding 1.7 but not exceeding 3.5 tons)	0.007 -53%	0.15 -40%	0.024 0%	0.63 0%	(exceeding 1.7 tons but not exceeding 2.5 tons) 2010 (exceeding 2.5 tons but not exceeding 3.5 tons) 2009
	Heavy-duty vehicles (GVW exceeding 3.5 tons)	0.01 -63%	(Next-phase targets) 0.7(-65%) (Challenge targets) Around one-third of 0.7 (-88%)	0.17 0%	2.22 0%	(exceeding 3.5 tons but not exceeding 12 tons) 2010 (exceeding 12 tons) 2009

Gasoline Motor Vehicles

		PM	NOx	NMHC	CO	Timetable (reference)
Passenger cars		0.005 (New)	0.05 0%	0.05 0%	0.15 0%	2009
Trucks/buses	Light-duty vehicles (GVW not exceeding 1.7 tons)	0.005 (New)	0.05 0%	0.05 0%	0.15 0%	2009
	Medium-duty vehicles (GVW exceeding 1.7 but not exceeding 3.5 tons)	0.007 (New)	0.07 0%	0.05 0%	2.55 0%	2009
	Heavy-duty vehicles (GVW exceeding 3.5 tons)	0.01 (New)	0.7(-0%)	0.23 0%	16.0 0%	2009

Note 3: With regard to “challenge targets” technological review shall be carried out in around 2008, and target values and the timetable for their achievement shall be finalized as necessary.

Note 4: Targets concerning PM for gasoline motor vehicles are applied only to lean-burn direct injection vehicles fitted with NOx adsorber catalysts.

Notice Concerning the "Future Policy for Motor Vehicle Emission Reduction (Eighth Report)" of the Central Environment Council

The Central Environment Council formally decides that diesel vehicle emissions will be reduced further from 2009

April 8, 2005 (Friday)

Secretariat of the Air Environment Committee
Central Environment Council

Environmental Control Technology Office
Policy and Coordination Division
Environmental Management Bureau
Ministry of the Environment
Director: Izumi Tokunaga (Extension: 6550)
Deputy Director: Hidenobu Kubota (Extension: 6552)

After passing the period of public comments (February 23 to March 30), the “Future Policy for Motor Vehicle Emission Reduction (Eighth) Report” proposed by the Air Environment Committee of the Central Environment Council on February 22, 2005 was discussed by the meeting of the Air Environment Committee of the Central Environment Council held on April 8. On the basis of these discussions, the chairperson of the Central Environment Council submitted a report to the Minister of the Environment that same day.

The main content of the report is a revision of the permissible limits for motor vehicle emission and the stipulation of “2009 Targets” for diesel motor vehicles.
When the regulations in accordance with this report are implemented, the same level of emission regulations will be implemented for diesel motor vehicles as for gasoline motor vehicles.
The reasoning behind this approach is as follows.

* To promote a dramatic reduction in particulate matter (PM) (a 99% reduction compared to when emissions were unregulated) in an endeavor to create a “PM-free” environment.
* To promote a dramatic reduction in nitrogen oxides (NOx) (a 96% reduction compared to when emissions were unregulated. Large trucks will be subject to the same regulation standard whether they have diesel or gasoline engines).

The Ministry of the Environment will take the necessary steps to strengthen regulations on the basis of the report by amending the notification based on the Air Pollution Control Law (Permissible Limits for Motor Vehicle Emissions).

Background

1. Discussions Held by the Air Environment Committee
(Formerly Air Quality Committee)

1996

May 21 — 12th meeting of the Air Quality Committee inquiry "Future Policy for Motor Vehicle Emission Reduction"

October 18 — 15th meeting of the Air Quality Committee/interim report → same day

Interim Report of the Central Environment Council

- Introduction of regulations on emissions from two-wheeled motor vehicles
- Reduction of benzene content in gasoline, etc.

1997

November 21 — 20th meeting of the Air Quality Committee/second report → same day

Second Report of the Central Environment Council

- Strengthening of regulations on gasoline motor vehicles
- Introduction of regulations on special motor vehicles, etc.

1998

December 14 — 22nd meeting of the Air Quality Committee/third report → same day

Third Report of the Central Environment Council

- Strengthening of regulations on diesel motor vehicles, etc.

2000

November 1 — 30th meeting of the Air Quality Committee/fourth report → same day

Fourth Report of the Central Environment Council

- Early establishment of new long-term targets for diesel motor vehicles, etc.

2002

April 16 — 4th meeting of the Air Environment Committee/fifth report → same day

Fifth Report of the Central Environment Council

- New long-term target levels for diesel motor vehicles
- Strengthening of regulations on gasoline motor vehicles (new long-term target levels)
- Methods for testing emissions from motor vehicles, etc.

2003

June 30 — 7th meeting of the Air Environment Committee/sixth report → same day

Sixth Report of the Central Environment Council

- Strengthening of regulations for two-wheeled motor vehicles
- Strengthening of regulations for special motor vehicles

July 29 — 8th meeting of the Air Environment Committee/seventh report → same day

Seventh Report of the Central Environment Council

2005

February 22 — 17th meeting of the Air Environment Committee

Strengthening of regulations concerning motor vehicle emissions beyond new long-term regulations

February 23 to March 30 — Public comments

April 8 — 18th meeting of the Air Environment Committee

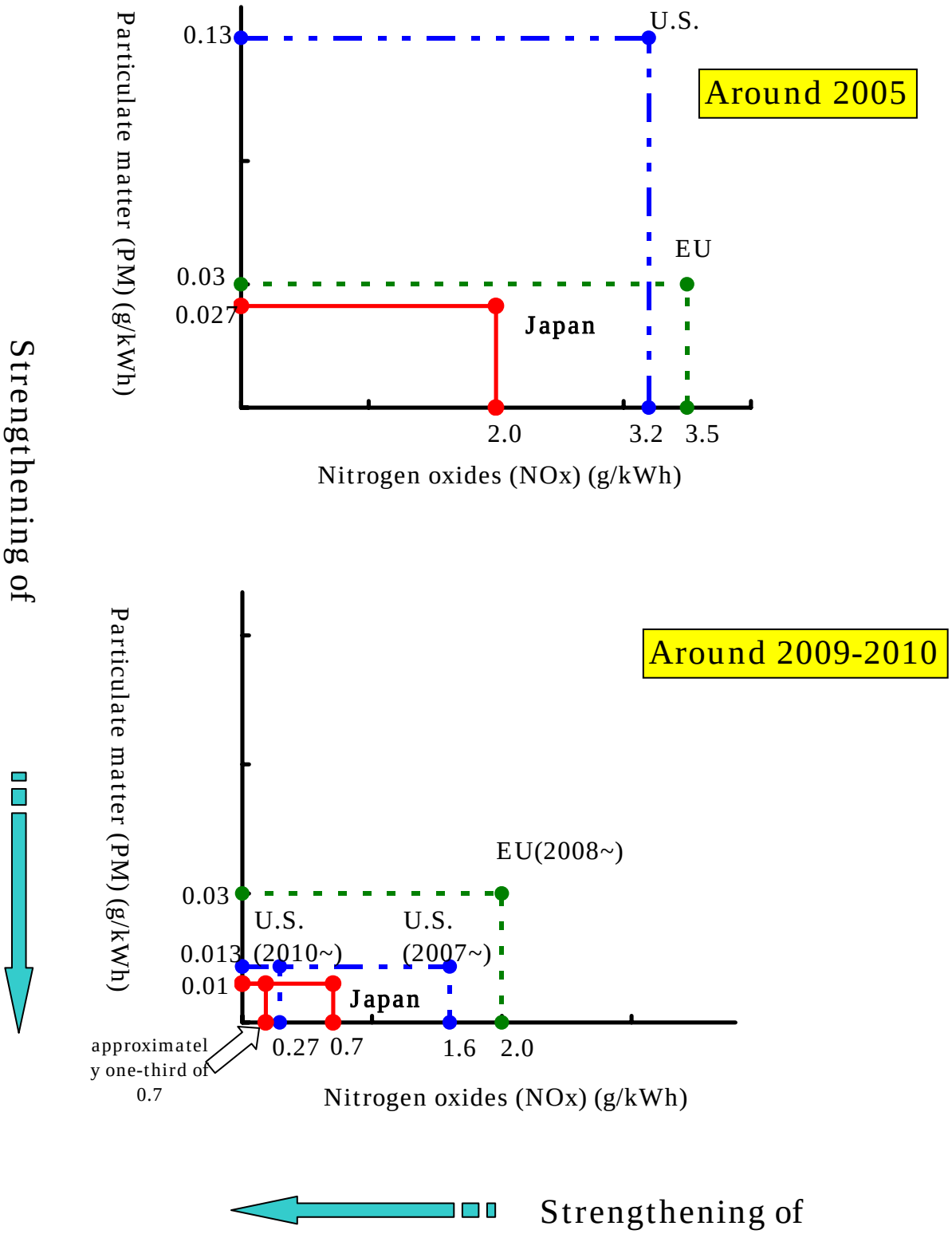
Eighth Report of the Central Environment Council

- 2009 Targets for diesel motor vehicles
- Introduction of PM regulations for gasoline motor vehicles, etc.

2. Discussions Held by the Experts Committee on Motor Vehicle Emissions (Relating to the Eighth Report)

* Experts Committee meetings held a total of 14 times
  (Including field investigations)
* Working Committee meetings held a total of 18 times
  (Including hearings with domestic and foreign vehicle manufacturers)
  # The Working Committee is a subcommittee of the Experts Committee.

Comparison of Heavy-Duty Diesel Motor Vehicle Emission Regulations



* Different testing modes have been established based on running conditions in each country.
* With regard to US regulations for 2010, review concerning technical aspects is currently taking place between the authorities and automobile manufacturers.