Future Policy for
Motor Vehicle Exhaust Emission Reduction

(Sixth Report)

June 30, 2003

Central Environment Council

Chukanshin No. 126
June 30, 2003

To: His Excellency Shunichi Suzuki
Minister of the Environment

From: Akio Morishima
Chairperson
Central Environment Council

Subject: “Future Policy for Motor Vehicle Exhaust Emission Reduction (Sixth Report)”

In response to an inquiry concerning “Future Policy for Motor Vehicle Exhaust Emission Reduction” (Inquiry No. 31, dated May 21, 1996), the Central Environment Council (Chukanshin) conducted studies and deliberations and submits the following report based on its conclusions.

Future Policy for Motor Vehicle Exhaust Emission Reduction (Sixth Report)

In response to an inquiry concerning “Future Policy for Motor Vehicle Exhaust Emission Reduction” (Inquiry No. 31, dated May 21, 1996), a total of five reports were completed: the Interim Report (October 1996); the Second Report (November 1997); the Third Report (December 1998); the Fourth Report (November 2000); and the Fifth Report (April 2002). These reports set new target levels for motor vehicles that use gasoline or liquefied petroleum gas (hereinafter called “gasoline/LPG motor vehicles”) and motor vehicles that use diesel oil (hereinafter called “diesel motor vehicles”) in a two-stage framework that includes new short-term and new long-term targets. The new long-term target levels for diesel motor vehicles in particular place priority on reducing emissions of particulate matter (PM) by 75 to 85% compared with the new short-term target levels and nitrogen oxides (NOx) by 41 to 50% by 2005, making them the strictest targets in the world. In order to achieve these new long-term targets, the permissible limit target level for sulfur content in gasoline and diesel oil has been set to 50 ppm or less, to be achieved by the end of 2004. With regard to two-wheeled motor vehicles (including motor-driven cycles, hereinafter collectively called “two-wheeled motor vehicles”), exhaust emission regulations were introduced in 1998 or 1999, depending on the vehicle category. Similarly, regulations were introduced for special vehicles that use diesel oil for fuel (hereinafter called “special diesel motor vehicles”) beginning in 2003.

The Experts Committee on Motor Vehicle Exhaust Emissions conducted a comprehensive review of policies for reducing motor vehicle exhaust emissions and wrote up the results in the Sixth Report.

Acting on the basis of the Sixth Report cited above, the Air Environment Committee engaged in discussions and, with the aim of accurately pursuing future emission reduction policies for motor vehicles, decided it was appropriate to adopt the Sixth Report of the Experts Committee on Motor Vehicle Exhaust Emissions, establish new reduction targets for two-wheeled motor vehicles and special motor vehicles, and continue conducting reviews of overall motor vehicle exhaust emission policy.

With these considerations in mind, the Central Environment Council submits the following report.

1. Measures to Reduce Exhaust Emissions from Two-Wheeled Motor Vehicles

1.1. Target Levels for Reducing Exhaust Emissions

Regulations were introduced to control nitrogen oxides (NOx), hydrocarbons (HC) and carbon monoxide (CO) exhaust emissions from two-wheeled motor vehicles in 1998 or 1999, depending on the vehicle category. In view of the fact that two-wheeled motor vehicles account for a large portion of total HC emitted from all motor vehicles, however, priority should be placed on strengthening measures to reduce HC emissions. Therefore, in working to strengthen exhaust emission measures, it's appropriate to apply the permissible limit target levels cited in Appendix 2 by using the exhaust emission testing methods described in Appendix 1, which replace the current testing mode with a cold start testing mode.

Using the permissible limit target levels shown in Appendix 2, it's appropriate to achieve the targets for first-class motor-driven cycles and mini-sized two-wheeled motor vehicles by the end of 2006, and the targets for second-class motor-driven cycles and small-sized two-wheeled motor vehicles by the end of 2007.

1.2. Measures to Maintain Performance Levels during Use, Etc.

To ensure that exhaust emission performance doesn't deteriorate during vehicle use, exhaust emission control systems must be appropriately durable, which makes it necessary to establish a required performance distance for these systems while taking into account actual conditions of use. Average travel distances are increasing for mini-sized two-wheeled motor vehicles and small-sized two-wheeled motor vehicles, making it appropriate to increase the required performance distance from the current 12,000 km to 24,000 km for these categories. It is also incumbent upon vehicle manufacturers to take steps in the production stage to help ensure that the systems they install continue to perform well in reducing exhaust emissions even after the required performance distance has been reached.

To ensure that exhaust emission control systems continue to function properly on vehicles in use, it is first of all important for the user to engage in appropriate maintenance activities through a strict regimen of inspections and repairs. In addition to this, however,

regulations should be implemented with regard to concentrations of CO and HC in exhaust emissions that are generated when the vehicle is idling (hereinafter called “idling regulations”) as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints, with the aim of discovering and removing maladjusted or inappropriately renovated exhaust emission control systems. To that end, permissible limits for idling must be reviewed without delay, with consideration given to the exhaust emission control technologies that are being used.

Studies should be conducted without delay regarding the development of measures to reduce exhaust emissions under running conditions and test conditions that are outside the scope of established test modes (off-cycle measures). As part of that effort, measures should be evaluated from the perspective of practical execution.

2. Measures to Reduce Exhaust Emissions from Special Motor Vehicles

2.1. Methods for Reducing Exhaust Emissions from Special Motor Vehicles

Current regulations apply only to special vehicles on public roads (hereinafter called “on-road vehicles”). This is because a framework created by the Ministry of Land, Infrastructure and Transport is already in place to govern exhaust emissions from construction machinery, and because of the fact that the same type of all-purpose engine is often mounted on a wide variety of different machines.

As regulations are strengthened on the basis of exhaust emission target levels for special diesel motor vehicles cited in this report, however, there is concern that vehicles that do not travel on public roads (hereinafter called “off-road vehicles”) might not meet the same standards for exhaust emissions that are in place for on-road vehicles. Similarly, there is concern that the use of fuels other than diesel oil in off-road vehicles that are fitted with new technologies to reduce exhaust emissions could greatly increase emission amounts and do damage to the vehicle itself. These concerns threaten to impede efforts to reduce emissions from off-road vehicles under the framework described above, and raise the possibility that no improvements will be manifested in the atmospheric environment. Therefore, when regulations are introduced on the basis of the exhaust emission reduction target levels cited in this report for diesel special motor vehicles, it is necessary to study the introduction of regulations for off-road vehicles in light of the exhaust emission measures cited above. In doing that, the framework should be studied with consideration given to the fact that off-road vehicles are manufactured in a “diverse product, small lot” production environment. Also, we cannot ignore the contribution to exhaust emissions that is made by engines used in portable electric power generators and other equipment, which are often the same engines that are used in special motor vehicles. Therefore, it is also necessary to conduct studies on applying exhaust emission regulations to these types of engines as well.

Advanced technologies designed to reduce exhaust emissions from diesel special motor vehicles are premised on the use of diesel oil for fuel. In view of the fact that, as mentioned above, fuels other than the diesel oil designated by manufacturers are reportedly widely used in off-road vehicles, it is important to conduct detailed surveys concerning actual fuel

use and to implement educational campaigns regarding the use of appropriate fuel. Once the results of these surveys, as well as the effects of both the educational campaigns and the regulations aimed at reducing exhaust emissions from off-road vehicles have been evaluated, consideration should be given to introducing further necessary regulations if it is found that the measures already taken are not adequate to achieve the desired reduction in exhaust emissions.

Also, to ensure that exhaust emission control devices installed in special motor vehicles are properly maintained during vehicle use, it is necessary to implement a user-targeted educational campaign regarding inspection and maintenance regimens. At the same time, technical development and appropriate measures must be pursued with engine manufacturers regarding such issues as ensuring durability, etc.

2.2. Expanding the Range of Special Motor Vehicles to Which Exhaust Emission Regulations Apply

Because of the following considerations, it is appropriate to apply exhaust emission regulations to special motor vehicles that use gasoline or LPG for fuel (hereinafter called “special gasoline/LPG motor vehicles”) with rated outputs ranging from 19 kW up to but not including 560 kW. First, despite being a rather small segment of the total special vehicle population in terms of absolute numbers, these vehicles account for a relatively high proportion of total exhaust emissions from special motor vehicles. Second, it is possible to reduce their exhaust emissions using the same technical measures that are applied to general gasoline/LPG motor vehicles.

In addition, it is desirable that the industry itself steadily implement autonomous measures for all engines that fall into output categories that are not subject to regulation.

2.3. Target Levels for Reducing Exhaust Emissions

2.3.1. Special Diesel Motor Vehicles

In light of the fact that special diesel motor vehicles are responsible for a relatively high proportion of the total exhaust emissions from all motor vehicles, measures should be strengthened with priority given to reducing PM and NOx emissions. Therefore, it is appropriate to work toward reducing PM, NOx, HC, and CO, and black smoke (a

component of PM) emissions in accordance with the permissible limit target levels shown in Appendix 3.

The permissible limit target levels shown in Appendix 3 are appropriate based on the assumption that design, development and production preparations will be accomplished efficiently, thus making it possible to achieve the targets for special motor vehicles with rated outputs from 130 kW up to but not including 560 kW by the end of 2006; the targets for special motor vehicles with rated outputs from 19 kW up to but not including 37 kW or from 75 kW up to but not including 130 kW by the end of 2007; and the targets for special motor vehicles with rated outputs from 37 kW up to but not including 75 kW by the end of 2008.

Because special motor vehicles are manufactured in a “diverse product, small lot” production environment, there is a great variety of vehicle categories and types that will come under regulation. Not only that, but the engines and car bodies of many machines are often made by different manufacturers, with car body manufacturers designing and developing their car bodies only after they receive the engine from the engine manufacturer. Because of this, manufacturers need development time in order to comply with the regulations. Particularly difficult challenges are posed by two ranges of engine size: engines ranging from 56 kW up to but not including 75 kW, which is the smallest range of engines that can accommodate exhaust emission control technologies adapted from those used in general diesel motor vehicles; and engines ranging from 130 kW up to but not including 560 kW, for which the least amount of development time is available before regulations take effect, which in turn makes it difficult to secure the labor hours required for production of these vehicles. For these two ranges in particular, measures must be taken to ensure conformity is smoothly achieved when the regulations come into effect.

After-treatment devices are indispensable for achieving substantial reductions in exhaust emissions from diesel engines. Regulations that are premised on the use of such after-treatment devices as diesel particulate filters (DPF) have been included in the new long-term targets for diesel motor vehicles which will come into effect in 2005. Looking to the future, similar regulations should also be introduced for special diesel motor vehicles.

Studies must also be conducted on the introduction of new exhaust emission testing methods that are designed to evaluate after-treatment devices. In view of the developmental period needed to apply after-treatment technology to special motor vehicles, as well as the probable evolution of a greater variety of vehicle types, it is estimated that DPG and other kinds of after-treatment devices will not be ready for practical applications before about 2010. It is appropriate to study regulatory details premised on after-treatment devices while monitoring progress in technical development. In view of these factors, we can expect the developmental period for coming into conformity with regulations to take longer than it would with ordinary motor vehicles, which means that a conclusion should be reached as early as possible.

Concerning HC emitted as blow-by gas, it is appropriate to quickly implement exhaust emission control measures at the stage in which some outlook of future technologies has been formed.

2.3.2. Special Gasoline/LPG Motor Vehicles

For special gasoline/LPG motor vehicles, measures should be strengthened with priority given to NOx and HC emissions. When strengthening measures to reduce exhaust emissions, the testing methods shown in Appendix 4 for measuring individual engines should be used to help reduce, by the end of 2007, exhaust emissions in accordance with the target levels for permissible limits for NOx, HC, and CO emissions as shown in Appendix 5.

Regarding HC emitted as blow-by gas, it is appropriate to implement measures in tandem with reducing exhaust-pipe emissions.

2.4. Measures to Maintain Performance Levels during Use

To help ensure that exhaust emissions do not increase during vehicle use, and to ensure that exhaust emission control devices are appropriately durable, it is necessary to establish standards for the length of service life, taking into account actual conditions of use. It is appropriate to set those standards as follows: 5,000 hours for special diesel motor vehicles with rated outputs from 19 kW up to but not including 37 kW; 5,000 hours for special gasoline/LPG motor vehicles; and 8,000 hours for special diesel motor vehicles with

rated outputs from 37 kW up to but not including 560 kW. It is also incumbent upon vehicle manufacturers to take steps in the production stage to help ensure that the systems they install continue to perform well in reducing exhaust emissions even after the required performance hours have been exceeded.

To ensure that exhaust emission control systems continue to function properly during use, it is first of all important for the user to engage in appropriate maintenance activities through a strict regimen of inspections and repairs. In addition to this, however, it is necessary to discover and remove maladjusted or inappropriately renovated exhaust emission control systems as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints. To that end, idling regulations for special gasoline/LPG motor vehicles must be implemented in the same way as they are for general gasoline/LPG motor vehicles. Permissible limits for idling should be established quickly, after taking into account the exhaust emission control technologies that are adopted in order to achieve the reduction targets cited in this report.

3. Future Measures to Reduce Exhaust Emissions from Motor Vehicles

3.1. Future Issues to Be Studied

This Council intends to continue studying the following issues, which include issues cited in Section 1 and 2 above.

(1) Concerning special diesel motor vehicles with rated outputs from 19 kW up to but not including 560 kW, studies will be conducted to thoroughly explore the possibility of adapting after-treatment devices (which will be applied in accordance with the new long-term regulations for general diesel motor vehicles), and to establish new reduction targets that should be achieved by around 2010. As part of that effort, consideration will also be given to introducing new exhaust emission testing methods.

(2) Concerning gasoline/LPG special motor vehicles with rated outputs from 19 kW up to but not including 560 kW, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on this report are faring, possibilities for further technical development, and the effects that various existing measures have had.

(3) No exhaust emissions reduction targets are currently set for special motor vehicles with rated outputs of less than 19 kW or 560 kW or more, or for general-purpose engines other than special motor vehicles. Studies will be conducted on introducing exhaust emission regulations for these machine categories, while monitoring such factors as the status of atmospheric pollution, changes in the proportion of total emissions accounted for by these machines, and progress in the development of exhaust emission control technologies.

(4) Concerning two-wheeled motor vehicles, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on this report are faring, possibilities for further technical development, and the effects that various existing measures have had. The introduction of regulations for evaporative emissions will be studied at the same time.

(5) Concerning diesel motor vehicles, studies will be conducted on new reduction targets, including the further reduction of sulfur content in diesel oil, while monitoring possibilities for further exhaust emission reductions. Concerning the establishment of specific permissible limit target levels for sulfur content in diesel oil, these levels are closely related to new exhaust emission target levels after the new long-term regulations come into effect. Therefore, while conducting studies and reaching conclusions as quickly as possible, studies will also be conducted on the quality of other fuels and lubricants. Although the quality of lubricants is currently not regulated, there is concern that the ash, sulfur, and other substances contained in lubricants could affect DPF and other after-treatment devices. Therefore, working in cooperation with vehicle manufacturers, fuel producers and others, it is desirable to conduct a review of standards related to lubricants as quickly as possible.

(6) Concerning gasoline/LPG motor vehicles, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on the new long-term targets for gasoline motor vehicles are faring, possibilities for further technical development, and the effects that various existing measures have had. Concerning the quality of fuel and lubricants (including the sulfur content of gasoline), cooperative research on the part of the Japanese government, vehicle manufacturers, fuel producers and other concerned parties will be promoted, focusing on reducing exhaust emissions through various combinations of improvements in vehicle technologies and fuel quality. On the basis of research results, studies will be conducted on measures related to fuel and lubricant quality.

(7) Research will be conducted on ultrafine particles emitted from diesel motor vehicles to: determine their number and other characteristics, establish measuring methods, and ascertain their effect on human health. On the basis of the results, consideration will be given to whether or not it is necessary to introduce appropriate regulations.

(8) To ensure the improvement or maintenance of the exhaust emission performance of motor vehicles, it's important to improve or maintain fuel quality. Recently, bio-derived fuels, dimethyl ether (DME), and a wide variety of other alternative fuels have gained attention, of which bio-derived fuels in particular have raised hopes with regard to

preventing global warming, etc. The Japanese government is conducting surveys and research on how the use of these fuels, or their mixture with conventional fuels, would affect exhaust emissions. Based on the results of those efforts, consideration will be given as needed to measures designed to prevent air pollution.

When conducting studies or implementing measures related to the issues cited above, it must be remembered that motor vehicles are products that are distributed internationally, and that measures to reduce exhaust emissions contain many elements that are commonly dealt with both within Japan and abroad. In view of this, it is important to harmonize Japanese regulations with international norms to the greatest extent possible whenever it can be done without adversely affecting Japan's own environmental protection efforts. Therefore, it is desirable for Japan to make active contributions to the harmonization of international standards related to such concerns as: methods for testing exhaust emissions from large-sized motor vehicles; onboard diagnostic systems (OBD); off-cycle measures; methods for testing exhaust emissions from two-wheeled motor vehicles; and methods for testing exhaust emissions from special motor vehicles, including general-purpose engines.

International harmonization will bring the following advantages:

- Promotion of technical development through more efficient R&D on the part of vehicle manufacturers, and reduction of development and production costs through the common use of parts
- Lower purchase prices for vehicle users

3.2. Related Measures

To supplement the measures indicated in this report, it is desirable to pursue comprehensive exhaust emission measures for motor vehicles and other related measures such as the following.

(Pursuing Comprehensive Exhaust Emission Measures)

On the basis of the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas (Automobile NOx/PM Law, promulgated on June 27, 2001) it is necessary to pursue comprehensive exhaust emission measures such as the following: strengthening regulations by vehicle

category; enhancing control measures for exhaust emissions from motor vehicles used for business purposes; promoting the dissemination of low-pollution vehicles.

(Promoting the Dissemination of Low-Pollution Vehicles, Etc.)
In accordance with the “Action Plan for Developing and Disseminating Low-Pollution Vehicles” that was completed on July 11, 2001, it is desirable for all ministries and agencies concerned to work together to further disseminate low-pollution vehicles.

(Measures to Reduce Exhaust Emissions from Vehicles in Use)
As indicated in the Fifth Report, etc., it will continue to be important to ensure that exhaust emission control systems function well on all gasoline/LPG and diesel motor vehicles that are in use. This is to be achieved by encouraging users to engage in appropriate maintenance activities through a strict regimen of inspections and repairs, and through checking exhaust emission control systems as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints.

Also, with regard to diesel motor vehicles that are in use, it is necessary to pursue such measures as promoting the dissemination of DPF and other devices.

In addition, in an effort to maintain the performance level of exhaust emission control systems during normal vehicle use, thought should be given to whether or not it is necessary to establish exhaust emission standards for vehicles in use, introduce surveillance systems, etc.

(Cost Burden, Etc.)
The process of implementing the exhaust emission reduction measures included in this report can be expected to have an effect on such costs as vehicle price, costs associated with ensuring engine durability, fuel costs, and maintenance costs. It will be necessary to have vehicles manufacturers and users bear these costs as part of the general environmental costs associated with using a motor vehicle.

It will also be necessary to make appropriate financial and tax arrangements to encourage people to exchange their vehicles for new ones that conform to the latest regulations, and to promote smooth improvement in fuel quality.

(Status Surveys and Measures for Unregulated Exhaust Emission Sources)
As stated in the Fifth Report, etc., it is necessary to continue to conduct surveys on the current status of various emission sources that are not yet regulated and to determine whether or not further measures are required. At the same time, studies must be conducted on what kinds of systems should be devised in order to implement those measures.

(Measures against Harmful Atmospheric Pollutants)
As stated in the Fifth Report, etc., it is desirable to establish the basis for an understanding of the amounts of harmful atmospheric pollutants being emitted by vehicles by developing measurement methods and improving measurement precision, and to formulate necessary policies on the basis of the information thus obtained.

In addition, efforts must be made to understand the effects that such factors as engine combustion technology, after-treatment devices (catalytic converters, etc.), and the quality of fuel and lubricants have on the amounts of harmful atmospheric pollutants that are emitted.

(Making Measurements of Exhaust Emissions from Vehicles More Precise)
As stated in the Fifth Report, regulations on gasoline/LPG motor vehicles and diesel motor vehicles will be greatly strengthened and target levels for exhaust emissions will be lowered. As this occurs, it is important for measurements to be reliable and to accurately understand the standards of quality that must be maintained during the manufacturing process. For this reason, it is necessary to pursue research aimed at improving measurement precision.

(Enhancing the Ability to Predict and Measure Effects)
As stated in the Fifth Report, as progress is made on vehicle measures and comprehensive vehicular exhaust emission measures, it will become increasingly important to plan and

execute policies based on accurate predictions of what effect a given measure will have, and on the measurement of that effect through precise monitoring. To that end, it is necessary to compile an inventory of PM, HC, and other substances generated by all mobile emission sources (including motor vehicles), fixed emission sources (such as factories and offices), and natural emission sources. It is also necessary to get an understanding of contributions to the secondary formation of such substances as suspended particulate matter (SPM) and photochemical oxidants. Therefore, it is desirable to develop methods for predicting and measuring the effects of various policies adopted to improve the quality of the atmosphere, and to establish systems that will help us to grasp the effects on the roadside and at other onsite locations.

Appendix 1

Exhaust Emission Measurement Modes Applied to Two-Wheeled Motor Vehicles

For two-wheeled motor vehicles, the mass of exhaust emissions is measured using in the following manner. Fifty-five kilograms are added to the weight of the vehicle, the engine is started, and the substances contained in the exhaust generated and emitted from the exhaust pipe into the atmosphere are measured under each set of conditions cited on the left side of the table. Six measurements are made under each set of conditions, with each measurement lasting the duration specified on the right side of the table.

Operating Conditions	Time (Seconds)
Engine running without load	11
Engine accelerating from zero to 15 km/h	4
Engine running steadily at 15 km/h	8
Engine decelerating from 15 km/h to zero	5
Engine running without load	21
Engine accelerating from zero to 32 km/h	12
Engine running steadily at 32 km/h	24
Engine decelerating from 32 km/h to zero	11
Engine running without load	21
Engine accelerating from zero to 50 km/h	26
Engine running steadily at 50 km/h	12
Engine decelerating from 50 km/h to 35 km/h	8
Engine running steadily at 35 km/h	13
Engine decelerating from 35 km/h to zero	12
Engine running without load	7

Appendix 2

Target Levels for Permissible Limits for Two-Wheeled Motor Vehicles

Category	Target Levels for Permissible Limits (Average Values)			Measurement Method
	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	
First-class motor-driven cycles	0.15 g/km	0.5 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Second-class motor-driven cycles	0.15 g/km	0.5 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Mini-sized two-wheeled motor vehicles	0.15 g/km	0.3 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Small-sized two-wheeled motor vehicles	0.15 g/km	0.3 g/km	2.0 g/km	Measurement modes cited in Appendix 1

Appendix 3

Target Levels for Permissible Limits for Special Diesel Motor Vehicles (Average Values)

<table>
<tr><th colspan="3" rowspan="2">Category</th><th colspan="5">Target Levels for Permissible Limits (Average Values)</th></tr>
<tr><th>Nitrogen Oxides</th><th>Hydro-carbons</th><th>Carbon Monoxide</th><th>Particulate Matter</th><th>Black Smoke</th></tr>
<tr><td rowspan="4">Special Vehicles That Use Diesel Oil for Fuel</td><td colspan="2">Rated output: 19 kW up to but not including 37 kW</td><td>6.0 g/kWh</td><td>1.0 g/kWh</td><td>5.0 g/kWh</td><td>0.4 g/kWh</td><td>40%</td></tr>
<tr><td rowspan="2">Rated output: 37 kW up to but not including 75 kW</td><td>Rated output: 37 kW up to but not including 56 kW</td><td rowspan="2">4.0 g/kWh</td><td rowspan="2">0.7 g/kWh</td><td rowspan="2">5.0 g/kWh</td><td>0.3 g/kWh</td><td>35%</td></tr>
<tr><td>Rated output: 56 kW up to but not including 75 kW</td><td>0.25 g/kWh</td><td>30%</td></tr>
<tr><td colspan="2">Rated output: 75 kW up to but not including 130 kW</td><td>3.6 g/kWh</td><td>0.4 g/kWh</td><td>5.0 g/kWh</td><td>0.2 g/kWh</td><td>25%</td></tr>
<tr><td colspan="2">Rated output: 130 kW up to but not including 560 kW</td><td>3.6 g/kWh</td><td>0.4 g/kWh</td><td>3.5 g/kWh</td><td>0.17 g/kWh</td><td>25%</td></tr>
</table>

Appendix 4

Exhaust Emission Measurement Modes Applied to Special Gasoline/LPG Motor Vehicles

For special gasoline/LPG motor vehicles, measurements are made in the following manner. The mass of substances contained in emissions from the exhaust pipe of the vehicle are measured per unit time while the vehicle is running under each condition cited on the left side of the table. Values are obtained by multiplying the results by the appropriate weighting factor shown on the right side of the table. Then the respective amounts of power generated under each of the conditions cited on the left side of the table are again multiplied by the appropriate weighting factor on the right side of the table to obtain a second set of values. The sum of the first set of values is divided by the sum of the second set of values to determine the mass of exhaust emissions per unit time and unit power.

Operating Conditions	Weighting Factor
Engine running at the speed of rated output with a full load	0.06
Engine running at intermediate speed (1) with a full load	0.02
Engine running at intermediate speed (1) with a 75% load	0.05
Engine running at intermediate speed (1) with a 50% load	0.32
Engine running at intermediate speed (1) with a 25% load	0.30
Engine running at intermediate speed (1) with a 10% load	0.10
Engine running without load	0.15

(1) When the speed at which maximum torque is generated falls 60% and 75% of the rated speed, that speed is defined as “intermediate speed.” When the speed at which maximum torque is generated is 60% of the rated speed or below, “intermediate speed” is defined as 60% of the rated speed. When the speed at which maximum torque is generated is 75% or above, “intermediate speed” is defined as 75% of the rated speed.

Appendix 5

Target Levels for Permissible Limits for Special Gasoline/LPG Motor Vehicles

Category		Target Levels for Permissible Limits (Average Values)			Measurement Method
		Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	
Special motor vehicles that use gasoline or liquefied petroleum gas for fuel	Rated output: 19 kW up to but not including 560 kW	0.6 g/kWh	0.6 g/kWh	20.0 g/kWh	Measurement modes cited in Appendix 4

Future Policy for Motor Vehicle Exhaust Emission Reduction (Sixth Report)

June 4, 2003

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

Future Policy for Motor Vehicle Exhaust Emission Reduction (Sixth Report)

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1. Introduction

1.1. Background to Motor Vehicle Exhaust Emission Control in Japan

In Japan, motor vehicle exhaust emission control began in 1966 with the regulation of carbon monoxide (CO) density for ordinary-sized and small-sized motor vehicles that use gasoline for fuel. Subsequently, additional regulations were applied to mini-sized motor vehicles and vehicles that use liquefied petroleum gas (hereinafter called "LPG") for fuel, as well as motor vehicles that use diesel oil (hereinafter called "diesel motor vehicles"). At the same time, the number of regulated substances was also successively increased, resulting in the current regulatory arrangement described below. For motor vehicles that run on gasoline and LPG (excluding two-wheeled motor vehicles) (hereinafter called "gasoline/LPG motor vehicles"), the three emission substances of CO, hydrocarbons (HC), and nitrogen oxides (NOx) are regulated; for diesel motor vehicles, two other substances are regulated in addition to the three cited above: particulate matter (PM) and black smoke contained in PM.

In 1997, revisions made in the Prime Minister's Office Ordinance and other regulations resulted in the addition of gasoline-fueled two-wheeled motor vehicles (including motor-driven cycles, hereinafter collectively called "two-wheeled motor vehicles") to the list of regulated vehicles. As a result, regulations were initiated for first-class motor-driven cycles and mini-sized two-wheeled motor vehicles in 1998, and for second-class motor-driven cycles and small-sized two-wheeled motor vehicles in 1999. Furthermore, regulations were adopted in 2003 to cover large-sized special motor vehicles and small-sized special motor vehicles that use diesel oil for fuel (hereinafter called "special diesel motor vehicles"), which apply to vehicles with rated outputs ranging from 19 kW up to but not including 560 kW.

Also, the Air Pollution Control Law was partially revised in 1995, thus establishing permissible limit target levels for the quality of gasoline and diesel oil used by vehicles for fuel. Based on this revision, motor vehicle fuel quality control began in 1996.

1.2. Background to Discussions Held by the Central Environment Council

Recent policies for reducing motor vehicle exhaust emissions have followed the targets indicated in a report issued in December 1989 by the Central Council for Environmental Pollution Control (Chukoshin) entitled, "Future Policy for Motor Vehicle Exhaust Emission Reduction" (Chukoshin No. 266, December 22, 1989. Hereinafter called the

"1989 Report"). All policies outlined in the 1989 Report were implemented by 1999, including policies designed to:

- Greatly reduce NOx, PM, and other emissions from diesel motor vehicles, etc. in accordance with a two-stage system of short- and long-term targets
- With regard to the quality of fuel for motor vehicles, reduce the sulfur content in diesel oil to one-tenth current levels in accordance with a two-stage system of short- and long-term targets (0.5 wt % to 0.2 wt % to 0.05 wt %).

Because arrangements had been made to completely implement all of the targets indicated in the 1989 Report, the Director-General of the Environment Agency sent an inquiry to the Central Environment Council in May 1996 concerning "Future Policy for Motor Vehicle Exhaust Emission Reduction" (Inquiry No. 31, May 21, 1996), which sparked discussion by members of the Air Quality Committee of the Central Environment Council, as well as this Experts Committee on Motor Vehicle Exhaust Emissions (hereinafter called "this Committee"), which was newly established as a part of the Air Quality Committee.

In response to the inquiry, a total of five reports were completed: the Interim Report (October 1996); the Second Report (November 1997); the Third Report (December 1998); the Fourth Report (November 2000); and the Fifth Report (April 2002).

These reports set new target levels for gasoline/LPG motor vehicles and diesel motor vehicles in a two-stage framework that includes new short-term and new long-term targets. The new short-term target levels for gasoline motor vehicles called for a reduction of NOx and HC emissions by about 70% compared with the old long-term target levels, depending on the vehicle category, to be achieved between the years 2000 and 2002 (a 50% reduction was slated for mini-sized trucks). The new short-term target levels for diesel motor vehicles called for a reduction of PM and NOx emissions by about 30% compared with the old long-term target levels, depending on the vehicle category, to be achieved between the years 2002 and 2004. The new long-term target levels for gasoline motor vehicles included stronger restrictions on NOx and other substances, while taking into account measures for reducing carbon dioxide. Specifically, this means reducing NOx emissions by 50 to 70% compared with the new short-term target levels for gasoline motor vehicles by 2005 (2007 for mini-sized trucks). The new long-term target levels for diesel motor vehicles place priority on reducing PM while continuing to

reduce NOx and other substances. Specifically, this means reducing PM by 75 to 85% compared with the new short-term target levels for diesel motor vehicles, and reducing NOx emissions by 41 to 50% by 2005. These levels are the strictest in the world. In order to achieve these new long-term targets, the permissible limit target level for sulfur content in gasoline and diesel oil has been set to 50 ppm or less, to be achieved by the end of 2004. In addition, changes will be made in the test mode during the years 2005 through 2011 with the aim of more accurately evaluating the emission performance of motor vehicles. The necessary measures have been formulated through the revision of the notification entitled "Permissible Limits for Motor Vehicle Exhaust Emissions" (hereinafter called "permissible limits"), based on the Air Pollution Control Law, and through other means; some of them have already been implemented.

With regard to two-wheeled motor vehicles, the Interim Report proposed that exhaust emission regulations be introduced in 1998 or 1999, depending on the vehicle category, and this proposal was carried out. The Second Report and Fourth Report proposed that regulations be introduced for special diesel motor vehicles beginning in 2003. Permissible limits have been revised and other necessary measures have been taken to implement this proposal.

Study Background and Summary of this Report

In accordance with the study policies indicated in the Fifth Report, this Committee met 20 times for discussions, including on-site inspections of the facilities of motor vehicle manufacturers, hearings participated in by industry organizations, and hearings conducted by a working committee established within this Committee, which were participated in by motor vehicle manufacturers. The conclusions reached concerning measures for reducing motor vehicle exhaust emissions are included in this report.

In Section 2, the views of this Committee are presented regarding the necessity of strengthening measures to reduce motor vehicle exhaust emissions; Section 3 covers measures to reduce emissions from two-wheeled motor vehicles; and Section 4 covers measures to reduce emissions from special motor vehicles. Section 5.1 deals with future topics for study, and Section 5.2 deals with related policies.

2. The Necessity of Strengthening Measures to Reduce Motor Vehicle Exhaust Emissions

In Japan, various measures have been implemented to prevent air pollution, including the strengthening of regulations pertaining to motor vehicle exhaust emissions. Particularly in large urban areas, Japan still faces severe air pollution conditions stemming from suspended particulate matter (SPM) and nitrogen dioxide (NO_2) emissions.

As described in the previous section, future exhaust reduction targets have already been established in previous reports for diesel motor vehicles and gasoline/LPG motor vehicles. As one way of regulating vehicles in use, special standards by vehicle category were implemented in October 2002 on the basis of the Law concerning Special Measures for Total Emission Reduction of Nitrogen Oxides and Particulate Matter from Automobiles in Specified Areas (hereinafter called the "Automobile NOx/PM Law"). The government has set the goal of meeting the environmental quality standards for SPM and NO_2 by 2010 via these measures.

In working to promote policies aimed at reducing motor vehicle exhaust emissions, this Committee has adopted the following basic assumptions, as indicated in the Fifth Report.

In trying to reduce motor vehicle exhaust emissions from the perspective of the relationship between atmospheric pollutants and motor vehicle exhaust emissions, priority must first be given to further strengthening measures designed to reduce PM and NOx emissions, while also working to reduce HC emissions.

(The Relationship between Atmospheric Pollutants and Motor Vehicle Exhaust Emissions)

- The reduction of PM emissions from motor vehicles is effective in reducing both concentrations of SPM in the atmosphere and the emission of harmful atmospheric pollutants. This makes it extremely important to implement measures designed to reduce motor vehicle exhaust emissions.
- The reduction of NOx emissions from motor vehicles is effective in reducing NO_2, SPM and photochemical oxidant concentrations in the atmosphere, as well as contributing to measures against acid rain. In view of this effectiveness, particularly

with regard to NO_2 control, it is extremely important to implement measures designed to reduce motor vehicle exhaust emissions.

- The reduction of HC emissions from motor vehicles is effective in reducing NO_2, SPM and photochemical oxidant concentrations in the atmosphere, as well as reducing the emission of harmful atmospheric pollutants and contributing to measures against acid rain. Therefore, measures to reduce motor vehicle exhaust emissions are very necessary.

Emissions from two-wheeled motor vehicles began to be regulated in October 1998, and emissions from special motor vehicles will be regulated beginning in October 2003. However, the total emissions generated by two-wheeled motor vehicles and special motor vehicles are increasing as a proportion of total emissions as regulations on diesel motor vehicles and gasoline/LPG motor vehicles have become significantly more stringent, as described in the previous section. In fiscal 2000, two-wheeled motor vehicles accounted for approximately 20% of all HC emissions from motor vehicles, and special vehicles accounted for about 15% of all PM emissions, 32% of all NOx emissions, and 13% of all HC emissions from motor vehicles. After the regulations described above are all implemented, however, and assuming that regulations concerning two-wheeled motor vehicle and special motor vehicle emissions are not strengthened, it is estimated that two-wheeled motor vehicles will account for about 21% of all HC emissions, and special motor vehicles will account for about 29% of all PM emissions, about 37% of all NOx emissions, and about 26% of all HC emissions. As these numbers suggest, the contribution to total emissions made by two-wheeled motor vehicles and special motor vehicles cannot be ignored, and it is therefore necessary to strengthen measures designed to reduce emissions from these sources in order to ensure that future environmental quality standards are met.

With the stronger regulation of motor vehicle exhaust emissions in recent years, rapid advances have been made in technologies designed to reduce emissions from gasoline and diesel engines. Although two-wheeled motor vehicles and special motor vehicles have been subject to relatively numerous and various restrictions with regard to conditions of use, vehicle body shape, and other aspects as compared with ordinary motor vehicles, it should be possible to apply the technologies that have hitherto been used in ordinary vehicles to further reduce emissions from two-wheeled motor vehicles and special motor vehicles. It should be noted that stronger emission regulations for two-wheeled motor vehicles and special motor vehicles are being planned in Europe and the United States, as well.

On the basis of the considerations cited above, this Committee conducted studies with the aim of clarifying both the current developmental status of exhaust emission-reducing technologies in Japan and abroad, and the potential for the future development of those technologies, while getting a grasp on the expenditures that are necessary for implementing emission controls. Through these studies, we concluded that it is necessary to pursue the motor vehicle exhaust emission reduction measures described in Sections 3 and 4 below.

3. Measures to Reduce Exhaust Emissions from Two-Wheeled Motor Vehicles

3.1. Technologies for Reducing Exhaust Emissions

Currently, the most advanced technologies for reducing exhaust emissions includes secondary air injection system for vehicles with four-cycle engines; electronically controlled fuel injection systems; three-way catalyst; and oxygen sensors. These technologies are already widely used in gasoline/LPG motor vehicles, as well as in some two-wheeled motor vehicles, centered on those with an engine displacement in excess of 1,000 cc that are exported to Europe. Last year, these technologies were also introduced in 125 cc-class two-wheeled motor vehicles exported to Taiwan.

For two-wheeled motor vehicles with small engine displacement, such as first-class motor-driven cycles, the use of these technologies presents various technical problems. It is difficult for fuel injection systems to control minimum fuel flow; the relatively large size of oxygen sensors makes it difficult to install them in small vehicles; and such systems increase the amount of electricity consumed. Therefore, the technologies cited above will be difficult to apply to small two-wheeled motor vehicles for the foreseeable future. For this reason, the most effective technologies for reducing two-wheeled motor vehicle exhaust emissions are considered to be such steps as further improving the fuel efficiency of the engine, and using secondary air injection systems and oxidation catalytic converters. Looking to the future, however, it is predicted that electronically controlled fuel injection systems and other technologies cited above will eventually be adapted for use with two-wheeled motor vehicles, thereby further reducing exhaust emissions.

Although the electronically controlled fuel injection systems and other technologies cited above are essentially the same as those used in gasoline/LPG motor vehicles, two-wheeled motor vehicles have limitations as described below that make technical applications more difficult, making it difficult to achieve the same levels of exhaust emission reductions as in gasoline/LPG motor vehicles.

(Why It Is Difficult to Achieve the Same Standards by Applying Gasoline/LPG Vehicle Technologies to Two-Wheeled Motor Vehicles)

(1) Size restrictions make it necessary to develop new, more compact electronically controlled fuel injection systems, engine control units, fuel pumps, catalytic converters, and other technologies. A smaller size is particularly needed for catalytic converters,

whose size is restricted by the size of the exhaust pipe and muffler, as well as the bank angle.
(2) Two-wheeled motor vehicles with a small engine displacement use a very small fuel flow, and it is technically difficult to build a fuel supply control system that has the necessary level of precision.
(3) Compared with gasoline/LPG motor vehicles, two-wheeled motor vehicles are controlled with an excessive fuel supply. If the supply is reduced to the equivalent of gasoline/LPG motor vehicles with the aim of reducing HC or CO emissions, there are concerns that it will negatively affect engine responsiveness and output characteristics, resulting in safety and performance problems.
(4) Because two-wheeled motor vehicles are less expensive than gasoline/LPG motor vehicles, the amount of money that can be expended on measures to reduce exhaust emissions is limited, which in turn places a limit on the technologies that can be used.

3.2. Exhaust Emission Testing Methods

The test mode currently in use for two-wheeled motor vehicles was established as part of the regulations adopted in 1998 and 1999, on the basis of surveys conducted on actual running conditions. Because only a few years have passed since their adoption, it can be assumed that those running conditions have undergone little change. The following review was carried out, however, with regard to cold start conditions, a consideration that was pointed out in previous reports.

Because it's likely that the next generation of regulations will require catalytic converters to be installed in all vehicle categories, it's important to assess the effect of cold starts on two-wheeled motor vehicles in the same way that assessments are carried out on other types of motor vehicles. When comparing emission amounts obtained from the test mode currently in use with those from the cold start test mode, we find that HC emissions are greater with cold starts, and that the effect of cold starts grows relatively greater as emission standards grow smaller.

In the current test mode, measurements are made of exhaust emissions over four cycles after the vehicle has been warmed up over two cycles. Using this six-cycle measurement (including the two for warm up), the following steps are taken to assess the effect of cold starts.

To ensure that actual use conditions are accurately reflected, the same new testing method is adopted as the one established in the Fifth Report for use with passenger cars,

etc. Therefore, tests are carried out as described above under both hot and cold conditions, and the values are weighted in accordance with ratios obtained from surveys of actual conditions, etc., in order to evaluate exhaust emission values. The cold start trip ratio (the ratio of the trip under cold conditions to the whole trip) is 0.896, which is higher than that of passenger cars, etc. (gasoline passenger cars have a ratio of 0.505). The length of a single trip averages 7.63 km, which is shorter than the 15.7 km average of gasoline passenger cars. This makes the cold start mode weighting factor for two-wheeled motor vehicles approximately 70%, which is considerably higher than the 26% averaged by passenger cars, etc. Because the cold start mode weighting factor is extremely high, there's relatively little difference between cold measurements and composite figures for cold and hot measurements calculated using the appropriate weighting factor. Therefore, it is believed that no great difference will be generated in the results if only cold starts are evaluated and hot condition tests are omitted. It should be noted that restricting testing to cold start measurements would make it possible to prevent increases in the number of hours of labor required.

Therefore, as indicated in Appendix 1, it is appropriate to convert the present testing mode to a cold start format, with measurements made of all six cycles (in contrast to the present practice of sampling cycles 3 through 6).

3.3. Target Levels for Reducing Exhaust Emissions

This Committee conducted its studies for each vehicle category while keeping in mind the necessity for measures to reduce motor vehicle exhaust emissions as described in Section 2 above, and while considering possible future developments with regard to exhaust emission reduction measures as described in Section 3.1 above. We concluded that it is appropriate to work toward reducing HC, NOx, and CO emissions in accordance with the permissible limit target levels shown in Appendix 2. With regard to setting permissible limit target levels for exhaust emissions from two-wheeled motor vehicles, priority should be given to reducing HC emissions in view of the fact that two-wheeled motor vehicle exhaust emissions account for a high proportion of all HC motor vehicle exhaust emissions. Therefore, targets for NOx and CO were set at levels that could be achieved while reducing HC emissions to a minimum.

The permissible limit target levels shown in Appendix 2 are appropriate based on the assumption that design, development and production preparations will be accomplished efficiently, thus making it possible to achieve the targets for first-class motor-driven cycles and mini-sized two-wheeled motor vehicles (which account for a high proportion of

total HC exhaust emissions) by the end of 2006, and the targets for second-class motor-driven cycles and small-sized two-wheeled motor vehicles by the end of 2007.

Concerning the regulation of evaporative emissions, the effect of such regulation is small compared with the reductions that can be achieved in HC emissions by strengthening regulations on emissions from exhaust pipes. Therefore, the introduction of regulations for evaporative emissions is given a low priority for the time being. However, as regulations on exhaust pipe emissions are further strengthened, the relative contribution to overall emissions accounted for by evaporative emissions is expected to increase, at which time it will become necessary to conduct studies on the introduction of appropriate regulations.

3.4. Measures to Maintain Performance Levels during Use, Etc.

3.4.1. Required Performance Distance

To achieve the exhaust emission reduction targets cited in this report, three-way catalytic converters and other exhaust emission control systems such as those described in Section 3.1 above will be necessary. If these systems are not adequately durable, however, there is concern that their performance will decline with use, resulting in an increase in exhaust emissions over time. Therefore, it is necessary to establish a required performance distance for these systems, while taking into account the average number of years of use and the distance traveled during that time. Average travel distances are increasing for mini-sized two-wheeled motor vehicles and small-sized two-wheeled motor vehicles, making it appropriate to increase the required performance distance from the current 12,000 km to 24,000 km for these categories. Because no great changes have been observed in the travel distances for first-class motor driven cycles and second-class motor driven cycles, it is appropriate to keep these settings at the current levels of 6,000 km and 8,000 km, respectively. It is also incumbent upon vehicle manufacturers to take steps in the production stage to help ensure that the systems they install continue to perform well in reducing exhaust emissions even after the required performance distance has been reached.

3.4.2. Idling Regulations

To ensure that exhaust emission control systems continue to function properly on vehicles in use, it is first of all important for the user to engage in appropriate maintenance activities through a strict regimen of inspections and repairs. In addition to

this, however, regulations are being implemented with regard to concentrations of CO and HC in exhaust emissions that are generated when the vehicle is idling (hereinafter called “idling regulations”) as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints, with the aim of discovering and removing maladjusted or inappropriately renovated exhaust emission control systems. Permissible limits for idling were set in the Interim Report with consideration given to the exhaust emission control technologies used on two-wheeled motor vehicles, with the understanding that it is appropriate to review and revise those levels as technical advances are made. Therefore, it is important to conduct a review as quickly as possible, with consideration given to the exhaust emission control technologies that will be used to achieve the target levels indicated in this report.

3.4.3. Measures to Reduce Exhaust Emissions under Conditions Other Than Those Covered by Test Modes (Off-Cycle Measures)

The test modes used are designed to test vehicular performance under average running conditions that occur most frequently. They do not, however, cover the many other, less frequently encountered conditions that can effect vehicle operation, such as travel at high speeds, rapid acceleration, operation in high (or low) temperatures, and operation at high altitudes. Therefore, even if emissions are effectively reduced when a vehicle is running under test-mode conditions, the effectiveness of the regulations will be compromised if emissions substantially increase when the vehicle is running under conditions outside the scope of the test modes, even if such conditions are only encountered infrequently. In the future, it’s expected that electronic control systems will be developed to make engine control systems more precise, as with gasoline/LPG vehicles. This will lead to a variety of control systems and, depending on the control method used, it could ultimately have a negative impact on emission performance under running conditions outside the scope of the test modes. Every effort should be made to prevent the deterioration of emission performance, except in cases where deterioration is necessary to protect the engine, etc. Therefore, as was proposed in the Fifth Report with regard to diesel motor vehicles and gasoline/LPG motor vehicles, it is necessary to conduct studies on specific methods and content for developing measures to reduce two-wheeled motor vehicle exhaust emissions under running conditions and test conditions that are outside the scope of the test modes. As part of that effort, it is also necessary to evaluate measures from the perspective of practical execution.

3.5. The Effects of Reducing Exhaust Emissions

According to estimates by the Ministry of the Environment, approximately 300,000 tons of HC were emitted from all vehicles (including two-wheeled motor vehicles and special motor vehicles) throughout Japan in fiscal 2000. Of this total HC amount, approximately 60,000 tons, or 20%, were emitted by two-wheeled motor vehicles.

Using various assumptions, the following trial calculations were performed to determine how much total HC emissions would be reduced if measures are implemented on the basis on the new exhaust emission target levels cited in this report.

(Reduction of Total Emissions from Two-Wheeled Motor Vehicles)
(1) Taking into account such factors as growth in two-wheeled motor vehicle traffic volume, changes in vehicular composition, and the gradual dissemination of vehicles that meet future regulations, total HC emissions from two-wheeled motor vehicles in fiscal 2010 would be approximately 67% lower than fiscal 2000 levels (declining from about 60,000 tons to about 20,000 tons).

(2) Assuming that two-wheeled motor vehicle traffic volume remains the same as in fiscal 2000 and that all relevant two-wheeled motor vehicles meet the standards cited in this report, total HC emissions from two-wheeled motor vehicles in fiscal 2010 would be reduced by approximately 95% (from about 60,000 tons to about 3,000 tons) compared with fiscal 2000 levels.

As these scenarios indicate, total HC emissions from two-wheeled motor vehicles would be significantly reduced if measures were adopted on the basis of the new exhaust emission reduction target levels for two-wheeled motor vehicles that are cited in this report. Scenario (1) assumes that two-wheeled motor vehicles would account for about 19% of all HC emissions in fiscal 2010, which is almost the same as the approximately 20% level estimated for fiscal 2000. Despite this, however, total emissions will be greatly reduced in the future as two-wheeled motor vehicles that meet the new exhaust emission target levels cited in this report are gradually disseminated.

4. Measures to Reduce Exhaust Emissions from Special Motor Vehicles

4.1. Methods for Reducing Exhaust Emissions from Special Motor Vehicles

The regulation of exhaust emissions from special motor vehicles is scheduled for implementation in 2003. Regulations are expected to apply only to special vehicles on public roads (hereinafter called “on-road vehicles”), and will function within the legal framework established by the Air Pollution Control Law, the Road Vehicles Act, and the Law on the Quality Control of Gasoline and Other Fuels.

At this time, the regulations will not apply to special motor vehicles that operate off of public roads (hereinafter called “off-road vehicles”), which account for approximately 80% of all exhaust emissions from special motor vehicles. However, through coordination with the Designation System for Exhaust Emission Control Type Construction Machinery initiated by the Ministry of Land, Infrastructure and Transport in 1991, many construction machines already conform with the established standards. Also, the fact that many different kinds of machines use the same engine models has resulted in a ripple effect. Therefore, the framework created by the Air Pollution Control Law and the Road Vehicles Act, coupled with the framework created by the Ministry of Land, Infrastructure and Transport for construction machinery, provides the basis for smooth and effective measures to reduce exhaust emissions from special vehicles.

As regulations are strengthened on the basis of exhaust emission target levels for special diesel motor vehicles cited in this report, however, the following developments can be anticipated with respect to off-road vehicles.

(1) Technology expenses associated with exhaust emission measures will increase, and it is expected that oxidation catalytic converters and other after-treatment devices will be introduced. Because of this, there is concern that manufacturers will change their specifications depending on whether or not the machine in question is used on public roads in order to boost their price competitiveness. This leads to concerns that off-road vehicles will no longer necessarily meet the same standards that apply to on-road vehicles.

(2) It’s said that many operators of special motor vehicles use heavy oil, kerosene, and other fuels other than the diesel oil specified by manufacturers. If these other fuels are used in vehicles that are fitted with new technologies to reduce exhaust emissions,

however, there's concern that emission performance will be seriously compromised, or that the vehicle will be damaged.

This being the case, it is highly likely that, under the framework described above, little progress will be made in reducing exhaust emissions from off-road vehicles, and there will be little improvement in the atmospheric environment as a result. Therefore, when regulations are introduced on the basis of the exhaust emission reduction target levels cited in this report for special diesel motor vehicles, it is necessary to study the introduction of regulations for off-road vehicles in light of the exhaust emission measures cited above. In doing that, the framework should be studied with consideration given to the fact that off-road vehicles are manufactured in a "diverse product, small lot" production environment. Also, we cannot ignore the contribution to exhaust emissions that is made by engines used in portable electric power generators and other equipment, which are often the same engines that are used in special motor vehicles. Therefore, it is also necessary to conduct studies on applying exhaust emission regulations to these types of engines as well.

In Europe and the US, broad exhaust emission regulations are applied to all on-road vehicles, off-road vehicles, and all-purpose engines other than those mounted on special motor vehicles.

Advanced technologies designed to reduce exhaust emissions from special diesel motor vehicles are premised on the use of diesel oil for fuel. In view of the fact that, as mentioned above, fuels other than the diesel oil designated by manufacturers are reportedly widely used in off-road vehicles, it is important to conduct detailed surveys concerning actual fuel use and to implement educational campaigns regarding the use of appropriate fuel. Once the results of these surveys, as well as the effects of both the educational campaigns and the regulations aimed at reducing exhaust emissions from off-road vehicles have been evaluated, consideration should be given to introducing further necessary regulations if it is found that the measures already taken are not adequate to achieve the desired reduction in exhaust emissions.

Also, owners and operators of off-road vehicles are not required to maintain their vehicles, and this means that the vehicles are often inadequately maintained. With the introduction of electronic control and advanced technologies for reducing exhaust emissions, the lack of proper maintenance could have a significant negative impact on exhaust emissions. To ensure that exhaust emission control devices installed in special

motor vehicles are properly maintained during vehicle use, it is necessary to implement a user-targeted educational campaign regarding inspection and maintenance regimens. At the same time, technical development and appropriate measures must be pursued with engine manufacturers regarding such issues as ensuring durability, etc.

4.2. Expanding the Range of Special Motor Vehicles to Which Exhaust Emission Regulations Apply

In previous reports, the approach described below was adopted with regard to the following types of special motor vehicles, for which exhaust emission reduction targets have not been established: special diesel motor vehicles with rated outputs of less than 19 kW or 560kW or more; and large-sized special motor vehicles and small-sized special motor vehicles that operate on gasoline or LPG (hereinafter called “special gasoline/LPG motor vehicles”). For these types of vehicles, it was decided to monitor atmospheric pollution conditions, changes in the proportion of emissions accounted for by these vehicles, developments in exhaust emission control technologies, and other factors, with the understanding that consideration would be given to introducing new regulations if deemed necessary.

Because of the following considerations, it is appropriate to apply exhaust emission regulations to special gasoline/LPG motor vehicles with rated outputs ranging from 19 kW up to but not including 560 kW. First, these vehicles account for about 8% of all NOx emissions from special motor vehicles, about 21% of all HC emissions, and about 61% of all CO emissions while only accounting for about 3% of the total number of special motor vehicles. Second, as described in Section 4.3.2 below, it is possible to reduce their exhaust emissions using the same technical measures that are applied to general gasoline/LPG motor vehicles. There are concerns that, if no measures are taken with respect to special gasoline/LPG motor vehicles, they will emit several tens of times more harmful exhaust gases than comparable general gasoline/LPG motor vehicles. It is possible to prevent this through the introduction of exhaust emission regulations. Special gasoline/LPG motor vehicles began to be regulated in California, USA in 2001, and similar regulations will come into force throughout the US in 2004.

Special gasoline/LPG motor vehicles with outputs of 560 kW or more are not found in Japan, and there are only about 700 special diesel motor vehicles of this size operating in Japan. Because they are so few in number, the contribution they make to total exhaust emissions is extremely small. Although large numbers of both special diesel and

special gasoline/LPG motor vehicles with outputs of less than 19 kW operate in Japan, the exhaust emissions they generate is extremely small both in absolute terms and as a proportion of the total exhaust emissions. For these reasons, both types of vehicles (very large and very small) do not merit a high priority as subjects of regulation. Nevertheless, it is desirable to gradually introduce applicable technologies for reducing exhaust emissions as they become available. With regard to general-purpose gasoline engines with outputs of less than 19 kW, including those used in special gasoline/LPG motor vehicles, the Japan Land Engine Manufacturers Association (LEMA) has voluntarily adopted the same standards as those mandated in the US, with steps being implemented on an autonomous basis beginning in January 2003. It should be noted that about 96% of all general-purpose gasoline engines with outputs of less than 19 kW sold in Japan are manufactured by LEMA members. It is desirable that the industry itself steadily implement autonomous measures for all engines that fall into output categories that are not subject to regulation.

4.3. Technologies for Reducing Exhaust Emissions from Special Motor Vehicles

4.3.1 Special Diesel Motor Vehicles

Compared with general diesel motor vehicles, special diesel motor vehicles involve many issues, as described below.

(1) The environment in which they are used is often harsh: they are operated in dusty or muddy places, left outside for long periods of time, etc.

(2) They are frequently used continuously with a highly loaded engine operating at high speed.

(3) Because of (1) and (2) above, stringent demands are placed on having durable and reliable engine parts.

(4) Travel speed is slow, with no benefit from a running wind during operation, resulting in inferior heat radiation.

(5) The need to ensure safety during operation and other considerations severely limit the amount of space available for installing equipment that reduces exhaust emissions; this is an especially difficult problem when dealing with small machines.

(6) Heavy oil and kerosene are sometimes used for fuel in off-road vehicles, and this places limits on the effective application of technologies for reducing exhaust emissions, which are premised on the use of diesel oil for fuel.

(7) The range of rated outputs is broader, with outputs that are not found in general motor vehicles. Because this makes it impossible to use existing technologies designed for general vehicles, it is necessary to develop new technologies.

(8) Because they are manufactured in a “diverse product, small lot” production environment, it takes time to develop engines and car bodies that conform to new regulations, and there is a heavy cost burden.
(9) In many cases, the engine manufacturer is not the same as the car body manufacturer, which makes it impossible for the engine manufacturer to design air intake/exhaust systems and after-treatment devices by itself. Also, because the car body manufacturer develops the new car body only after the engine manufacturer has developed a new engine, overall development takes a long time.
(10) Because small engines are relatively inexpensive, there is a limit to the cost that can be added by measures to reduce exhaust emissions. This in turn restricts the kinds of technologies that can be used.
(11) The use of direct injection systems on small engines is difficult because it increases the noise level and poses other problems.

Because of these factors, it is difficult to immediately achieve the same level of exhaust emission reduction in special diesel motor vehicles that can be achieved in general diesel motor vehicles. Nevertheless, some technological methods that are used in general diesel motor vehicles can be applied to special diesel motor vehicles, including: improving the combustion chamber and air intake system; improving the fuel injection system, including such aspects as electronic control and common-rail high-pressure fuel injection; cooling the EGR gas emitted from exhaust gas recirculation systems (EGR systems); and using turbochargers fitted with charge air coolers, oxidation catalytic converters and other devices. Through the combined application of these technologies, it should be possible to reduce exhaust emissions from special diesel motor vehicles. Engines with outputs of less than 56 kW, however, have small exhaust emission amounts that do not exist in general diesel motor vehicles, and tend to feature indirect fuel injection systems, which makes it impossible to apply exhaust emission control technologies that were developed for direct fuel injection engines. Also, these smaller engines are inexpensive, which limits how much people are willing to spend on emission reduction measures, which in turn limits the types of technologies that can be used. Therefore, basic emphasis should be placed on making further improvements in the combustion chamber, air intake system, and fuel injection system and, for those engines that are amenable to it, efforts should be made to further reduce emissions through the use of EGR systems, oxidation catalytic converters, electronic control, and other applicable technologies.

Acting in advance of regulatory requirements, Japanese fuel producers voluntarily committed themselves in April of this year to disseminating low-sulfur diesel oil with a sulfur content of 50 ppm. Assuming that this diesel oil is used, the effectiveness of oxidation catalytic converters in reducing PM and other emissions will increase. The use of low-sulfur diesel oil in itself will also contribute slightly to lower PM emissions.

4.3.2. Special Gasoline/LPG Motor Vehicles

Because special gasoline/LPG motor vehicles are subject to many of the same limitations cited above for special diesel motor vehicles, it is difficult to directly apply the same exhaust emission control technologies that are used for general gasoline/LPG motor vehicles. Nevertheless, some technological methods that are used in general gasoline/LPG motor vehicles can be applied to special gasoline/LPG motor vehicles, including: improving combustion by optimizing the structure of the combustion chamber; improving the fuel injection system; controlling the air/fuel ratio more precisely; and making other improvements in the engine itself. Further possible steps that can be taken to reduce exhaust emissions include using three-way catalytic converters and other devices.

4.4. Exhaust Emission Testing Methods

4.4.1. Special Diesel Motor Vehicles

The exhaust emission testing methods currently used were newly set by regulations that came into effect in 2003. Since it can be assumed that virtually no changes have occurred in conditions since then, it is appropriate to continue using them.

4.4.2. Special Gasoline/LPG Motor Vehicles

Unlike general motor vehicles, special motor vehicles are characterized by the following: 1) many different types of special motor vehicles use the same type of engine, which is often also used in vehicles overseas; and 2) special motor vehicles that belong to the same machine category can be fitted with engines that vary widely in terms of output and performance characteristics. Therefore, as is the case with special diesel motor vehicles, it is appropriate to adopt engine-based exhaust emission testing methods in order to efficiently and steadily reduce exhaust emissions from special gasoline/LPG motor vehicles.

Atmospheric pollutants emitted by special gasoline/LPG motor vehicles are almost all emitted while the vehicle is working (as opposed to simply traveling). In order to make accurate reductions in exhaust emissions, it is therefore necessary to be able to make

correct assessments of emission conditions when the machine is working, and to furthermore adopt effective testing methods that will contribute to reduced exhaust emissions when the vehicle is traveling.

Several factors were taken into consideration in studying methods for testing exhaust emissions generated by special gasoline/LPG motor vehicles. First, there is virtually no difference between Japan and other countries with regard to engine running conditions and other aspects governing the actual use of special gasoline/LPG motor vehicles in the field, which is when they generate nearly all of their emissions. Second, it is desirable to harmonize Japan's testing facilities and methods with international norms to the greatest extent possible, as long as Japan's efforts to protect the environment are not compromised. In light of these considerations, the studies focused on the C2 cycle specified by ISO 8178-4, a standard formulated by the International Organization for Standardization (ISO), which has also been adopted by the USA in its exhaust emission regulations for special gasoline/LPG motor vehicles. The studies confirmed that the conditions under which special gasoline/LPG motor vehicles are used, both on the road and off, are generally the same as those assumed by ISO C2 cycle, leading to the conclusion that regulations based on the C2 cycle are appropriate for evaluating engine running conditions during actual use, and will have a fully adequate effect in reducing exhaust emissions.

The ISO C2 cycle was formulated on the basis of surveys of engine speed, load, and other factors conducted on construction machinery, agricultural machines, forklifts, and other equipment that are fitted with gasoline/LPG engines. It is widely used internationally as a mode that provides a grasp of the exhaust emission characteristics of all special gasoline/LPG motor vehicles.

In light of all of the above, Japan will use the ISO C2 cycle as shown in Appendix 3 when implementing exhaust emission reduction regulations for special gasoline/LPG motor vehicles fitted with engines with rated outputs from 19 kW up to but not including 560 kW.

4.5. Target Levels for Reducing Exhaust Emissions

4.5.1. Special Diesel Motor Vehicles

This Committee conducted its studies for each output range while keeping in mind the necessity for measures to reduce motor vehicle exhaust emissions as described in Section

2 above, and while considering possible future developments with regard to exhaust emission reduction measures as described in Section 4.3.1 above. We concluded that it is appropriate to work toward reducing PM, NOx, HC, and CO, and black smoke (a component of PM) emissions in accordance with the permissible limit target levels shown in Appendix 4.

The permissible limit target levels shown in Appendix 4 are appropriate based on the assumption that design, development and production preparations will be accomplished efficiently, thus making it possible to achieve the targets for special motor vehicles with rated outputs from 130 kW up to but not including 560 kW by the end of 2006; the targets for special motor vehicles with rated outputs from 19 kW up to but not including 37 kW or from 75 kW up to but not including 130 kW by the end of 2007; and the targets for special motor vehicles with rated outputs from 37 kW up to but not including 75 kW by the end of 2008.

Because special motor vehicles are manufactured in a “diverse product, small lot” production environment, there is a great variety of vehicle types and models that will come under regulation. Not only that, but the engines and car bodies of many machines are often made by different manufacturers, with car body manufacturers designing and developing their car bodies only after they receive the engine from the engine manufacturer. Because of this, manufacturers need development time in order to comply with the regulations. Particularly difficult challenges are posed by two ranges of engine size: engines ranging from 56 kW up to but not including 75 kW, which is the smallest range of engines that can accommodate exhaust emission control technologies adapted from those used in general diesel motor vehicles; and engines ranging from 130 kW up to but not including 560 kW, for which the least amount of development time is available before regulations take effect, which in turn makes it difficult to secure the labor hours required for production of these vehicles. For these two ranges in particular, measures must be taken to ensure conformity is smoothly achieved when the regulations come into effect.

In Europe and the US, proposals to strengthen regulations have been publicly announced that will reduce combined NOx and HC emissions by approximately 40% from 2006 through 2008. However, the fuel used in special diesel motor vehicles in the US currently has a sulfur content of about 3,000 ppm, and low-sulfur diesel oil will not be widely disseminated until after around 2009. This limits the types of technologies

that can be applied, and the US will therefore make no effort to strengthen standards for PM emissions in the next generation of regulations. Compared with ordinary motor vehicles, special motor vehicles have a small, single, global market that emphasizes international compatibility, with international coordination sought to the greatest degree possible. For this reason, the European Commission places priority on achieving harmony with the US, and accordingly announced a regulatory proposal in January of this year that does not strengthen PM standards.

Although we understand the importance of international cooperation, Japan has a strong need to reduce PM emissions (as stated in Section 2 above), and therefore finds it necessary to enforce standards that will reduce PM emissions in the next generation of regulations.

After-treatment devices are indispensable for achieving substantial reductions in exhaust emissions from diesel engines. Regulations that are premised on the use of such after-treatment devices as diesel particulate filters (DPF) have been included in the new long-term targets for diesel motor vehicles which will come into effect in 2005. Looking to the future, similar regulations should also be introduced for special diesel motor vehicles. Studies must also be conducted on the introduction of new exhaust emission testing methods that are designed to evaluate after-treatment devices. In view of the developmental period needed to apply after-treatment technology to special diesel motor vehicles, as well as the probable evolution of a greater variety of vehicle types, it is estimated that DPF and other kinds of after-treatment devices will not be ready for practical applications before about 2010. It is appropriate to study regulatory details premised on after-treatment devices while monitoring progress in technical development. In view of these factors, we can expect the developmental period for coming into conformity with regulations to take longer than it would with ordinary motor vehicles, which means that a conclusion should be reached as early as possible. In Europe and the US, a proposal has been made to strengthen regulations with the aim of greatly reducing PM levels starting in 2011, premised on the use of DPF. In the regulatory proposal made by the US, NOx emissions will be greatly reduced at the same time as PM emissions, again premised on the application of after-treatment devices.

Concerning HC emitted as blow-by gas, the Third Report specifies that measures should be implemented on the basis of the new short-term targets for general diesel motor vehicles. For special diesel motor vehicles, however (especially those fitted with engines with high rated outputs and those fitted with turbochargers), technical development

must be carried out to ensure the durability and reliability of the devices in question. Therefore, it is appropriate to quickly implement exhaust emission control measures when the stage is reached in which some outlook of future technologies has been formed. In the US, regulations of blow-by gas will be implemented beginning in 2004, applicable only to diesel engines that are not turbocharged.

4.5.2. Special Gasoline/LPG Motor Vehicles

While keeping in mind the need to reduce exhaust emissions from motor vehicles as stated in Section 2 above, and future technical development, this Committee conducted a technical study concerning the measures to reduce exhaust emissions outlined in Section 4.3.2 above. As a result of that study, we concluded that it is appropriate to work to reduce NOx, HC and CO emissions in accordance with the target level for permissible limits as shown in Appendix 5 by 2007.

Regarding HC emitted as blow-by gas, many vehicles that are sold domestically are already subject to exhaust emission control measures, and it is appropriate to implement measures along with reducing exhaust-pipe emissions.

4.6. Measures to Maintain Performance Levels during Use

To achieve the reductions targets cited in this report, it will be necessary to use catalytic converters and other exhaust emission control devices, as described in Section 4.3 above. If these devices are not adequately durable, there is concern that their performance will decline in the process of use and that exhaust emissions will therefore increase. Therefore, it is necessary to set standards for the length of service life, taking into account such factors as average years of use and number of hours of use during that period. It is appropriate to set those standards as follows: 5,000 hours for special diesel motor vehicles with rated outputs from 19 kW up to but not including 37 kW; 5,000 hours for special gasoline/LPG motor vehicles; and 8,000 hours for special diesel motor vehicles with rated outputs from 37 kW up to but not including 560 kW. It is also incumbent upon vehicle manufacturers to take steps in the production stage to help ensure that the systems they install continue to perform well in reducing exhaust emissions even after the required performance hours have been exceeded.

To ensure that exhaust emission control systems continue to function properly during use, it is first of all important for the user to engage in appropriate maintenance activities through a strict regimen of inspections and repairs. In addition to this, however, it is necessary to discover and remove maladjusted or inappropriately

renovated exhaust emission control systems as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints. As with general diesel motor vehicles, no-load acceleration tests are being implemented on special diesel motor vehicles (vehicles in use) in order to check black smoke emissions. However, it is also necessary to implement idling regulations for special gasoline/LPG motor vehicles in the same way that general gasoline/LPG motor vehicles are regulated. Permissible limits for idling should be established quickly, after taking into account the exhaust emission control technologies that are adopted in order to achieve the reduction targets cited in this report.

4.7. The Effects of Reducing Exhaust Emissions

According to estimates by the Ministry of the Environment, approximately 76,000 tons of PM, 950,000 tons of NOx, and 300,000 tons of HC were emitted from all vehicles (including two-wheeled motor vehicles and special vehicles) throughout Japan in fiscal 2000. Of these amounts, special motor vehicles accounted for about 11,000 tons (15%) of PM, 310,000 tons (32%) of NOx, and 40,000 tons (13%) of HC.

Using various assumptions, the following trial calculations were performed to determine the extent to which total emissions would be reduced if measures are implemented for special motor vehicles on the basis on the new exhaust emission target levels cited in this report.

(Reduction of Total Emissions from Special Motor Vehicles)
(1) Taking into account such factors as changes in use conditions and number of vehicles, and assuming the gradual dissemination of vehicles that meet future regulations, total emissions from special motor vehicles in fiscal 2010 will be reduced compared with fiscal 2000 levels as shown in the following scenarios:

About a 26% reduction in PM emissions (from about 11,000 tons to about 8,000 tons)
About a 38% reduction in NOx emissions (from about 310,000 tons to about 190,000 tons)
About a 35% reduction in HC emissions (from about 39,000 tons to about 25,000 tons)

(2) Assuming that use conditions and the number of vehicles remains unchanged from fiscal 2000 levels, and that all relevant special motor vehicles are regulated on the basis of the provisions cited in this report, total emissions from special motor vehicles in fiscal 2010 will be reduced as shown below:

About a 46% reduction in PM emissions (from about 11,000 tons to about 6,000 tons)
About a 65% reduction in NOx emissions (from about 310,000 tons to about 110,000 tons)
About a 57% reduction in HC emissions (from about 39,000 tons to about 17,000 tons)

As these scenarios indicate, total exhaust emissions from special motor vehicles would be significantly reduced if measures were adopted on the basis of the new exhaust emission reduction target levels for special motor vehicles that are cited in this report. With Scenario (1), however, the amount of total motor vehicle exhaust emissions accounted for by special motor vehicles would stay approximately the same for NOx (at about 34% in fiscal 2010 as compared with about 32% in fiscal 2000) and would actually rise for PM (from about 15% in fiscal 2000 to about 28% in fiscal 2010) and HC (from about 13% to about 24%). This can be attributed to two things: first, the new exhaust emissions target levels for special motor vehicles outlined in this report are expected to be achieved from 2006 to 2008, so that their reduction effects will not yet be fully manifested by fiscal 2010; second, regulations on emissions from general vehicles will be substantially strengthened beginning in 2005, resulting in a reduction in total exhaust emissions. As was mentioned in Section 4.5.1 above, regulations premised on after-treatment devices such as DPF are scheduled to come into force around 2010, which is expected to greatly reduce exhaust emissions from special diesel motor vehicles.

5. Future Measures to Reduce Exhaust Emissions from Motor Vehicles

5.1. Future Issues to Be Studied

This Committee intends to continue studying the following issues, which include issues cited in Section 3 above.

(1) Concerning special diesel motor vehicles with rated outputs from 19 kW up to but not including 560 kW, studies will be conducted to thoroughly explore the possibility of adapting after-treatment devices (which will be applied in accordance with the new long-term regulations for general diesel motor vehicles), and to establish new reduction targets that should be achieved by around 2010. As part of that effort, consideration will also be given to introducing new exhaust emission testing methods.

(2) Concerning special gasoline/LPG motor vehicles with rated outputs from 19 kW up to but not including 560 kW, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on this report are faring, possibilities for further technical development, and the effects that various existing measures have had.

(3) No exhaust emissions reduction targets are currently set for special motor vehicles with rated outputs of less than 19 kW or 560 kW or more, or for general-purpose engines other than special motor vehicles. Studies will be conducted on introducing exhaust emission regulations for these machine categories, while monitoring such factors as the status of atmospheric pollution, changes in the proportion of total emissions accounted for by these vehicles and machines, and progress in the development of exhaust emission control technologies.

(4) Concerning two-wheeled motor vehicles, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on this report are faring, possibilities for further technical development, and the effects that various existing measures have had. The introduction of regulations for evaporative emissions will be studied at the same time.

(5) Concerning diesel motor vehicles, studies will be conducted on new reduction targets, including the further reduction of sulfur content in diesel oil, while monitoring possibilities for further exhaust emission reductions. Concerning the establishment of specific permissible limit target levels for sulfur content in diesel oil, these levels are

closely related to new exhaust emission target levels after the new long-term regulations come into effect. Therefore, while conducting studies and reaching conclusions as quickly as possible, studies will also be conducted on the quality of other fuels and lubricants. Although the quality of lubricants is currently not regulated, there is concern that the ash, sulfur, and other substances contained in lubricants could affect DPF and other after-treatment devices. Therefore, working in cooperation with vehicle manufacturers, fuel producers and others, it is desirable to conduct a review of standards related to lubricants as quickly as possible.

(6) Concerning gasoline/LPG motor vehicles, studies will be conducted on establishing new reduction targets as needed while monitoring how the regulations based on the new long-term targets for gasoline motor vehicles are faring, possibilities for further technical development, and the effects that various existing measures have had. Concerning the quality of fuel and lubricants (including the sulfur content of gasoline), cooperative research on the part of the Japanese government, vehicle manufacturers, fuel producers and other concerned parties will be promoted, focusing on reducing exhaust emissions through various combinations of improvements in vehicle technologies and fuel quality. On the basis of research results, studies will be conducted on measures related to fuel and lubricant quality.

(7) Regulations on PM emissions from diesel motor vehicles are implemented on the basis of weight. Recently, however, there has been heightened concern both in Japan and abroad that the quality of the particles (the number of ultrafine particles, the particles' composition, etc.) also has a deep connection to PM's effect on human health. Unfortunately, the true status of these emissions is not clearly understood, in part because no methods have been established to measure the quality of particles emitted from diesel motor vehicles. It has also been pointed out that direct-injection gasoline engines, which are being widely disseminated as a means of improving gas mileage, emit extremely small particles, the exact nature of which is currently unclear. Therefore, research will be pursued on clarifying the true nature of PM emissions and establishing measuring methods. On the basis of the results, consideration will be given to whether or not it is necessary to introduce appropriate regulations.

(8) To ensure the improvement or maintenance of the exhaust emission performance of motor vehicles, it's important to improve or maintain fuel quality. Recently, bio-derived fuels, dimethyl ether (DME), and a wide variety of other alternative fuels have gained attention, of which bio-derived fuels in particular have raised hopes with regard to

preventing global warming, etc. The Japanese government is conducting surveys and research on how the use of these fuels, or their mixture with conventional fuels, would affect exhaust emissions. Based on the results of those efforts, consideration will be given as needed to measures designed to prevent air pollution.

When conducting studies or implementing measures related to the issues cited above, it must be remembered that motor vehicles are products that are distributed internationally, and that measures to reduce exhaust emissions contain many elements that are commonly dealt with both within Japan and abroad. In view of this, it is important to harmonize Japanese regulations with international norms to the greatest extent possible whenever it can be done without adversely affecting Japan's own environmental protection efforts. Therefore, it is desirable for Japan to make active contributions to the harmonization of international standards related to such concerns as: methods for testing exhaust emissions from large-sized motor vehicles; onboard diagnostic systems (OBD); off-cycle measures; methods for testing exhaust emissions from two-wheeled motor vehicles; and methods for testing exhaust emissions from special motor vehicles, including general-purpose engines.

International harmonization will bring the following advantages:

- Promotion of technical development through more efficient R&D on the part of vehicle manufacturers, and reduction of development and production costs through the common use of parts
- Lower purchase prices for vehicle users

5.2. Related Measures

To supplement the measures indicated in this report, it is desirable to pursue comprehensive exhaust emission measures for motor vehicles and other related measures such as the following.

(Pursuing Comprehensive Exhaust Emission Measures)

On the basis of the Automobile NOx/PM Law promulgated on June 27, 2001, it is necessary to pursue comprehensive exhaust emission measures such as the following: strengthening regulations by vehicle category; enhancing control measures for exhaust emissions from motor vehicles used for business purposes; promoting the dissemination of low-pollution vehicles.

(Promoting the Dissemination of Low-Pollution Vehicles, Etc.)

In accordance with the “Action Plan for Developing and Disseminating Low-Pollution Vehicles” that was completed on July 11, 2001, it is desirable for all ministries and agencies concerned to work together to further disseminate low-pollution vehicles.

(Measures to Reduce Exhaust Emissions from Vehicles in Use)
As indicated in the Fifth Report, etc., it will continue to be important to ensure that exhaust emission control systems function well on all gasoline/LPG and diesel motor vehicles that are in use. This is to be achieved by encouraging users to engage in appropriate maintenance activities through a strict regimen of inspections and repairs, and through checking exhaust emission control systems as part of mandated vehicle inspections required by the Road Vehicles Act and traffic checkpoints.

Also, with regard to diesel motor vehicles that are in use, it is necessary to pursue such measures as promoting the dissemination of DPF and other devices.

In addition, in an effort to maintain the performance level of exhaust emission control systems during normal vehicle use, thought should be given to whether or not it is necessary to establish exhaust emission standards for vehicles in use, introduce surveillance systems, etc.

(Cost Burden, Etc.)
The process of implementing the exhaust emission reduction measures included in this report can be expected to have an effect on such costs as vehicle price, costs associated with ensuring engine durability, fuel costs, and maintenance costs. It will be necessary to have vehicles manufacturers and users bear these costs as part of the general environmental costs associated with using a motor vehicle.

It will also be necessary to make appropriate financial and tax arrangements to encourage people to exchange their vehicles for new ones that conform to the latest regulations, and to promote smooth improvement in fuel quality.

(Status Surveys and Measures for Unregulated Exhaust Emission Sources)
As stated in the Fifth Report, etc., it is necessary to continue to conduct surveys on the current status of various emission sources that are not yet regulated and to determine whether or not further measures are required. At the same time, studies must be conducted on what kinds of systems should be devised in order to implement those measures.

(Measures against Harmful Atmospheric Pollutants)
As stated in the Fifth Report, etc., it is desirable to establish the basis for an understanding of the amounts of harmful atmospheric pollutants being emitted by vehicles by developing measurement methods and improving measurement precision, and to formulate necessary policies on the basis of the information thus obtained.

In addition, efforts must be made to understand the effects that such factors as engine combustion technology, after-treatment devices (catalytic converters, etc.), and the quality of fuel and lubricants have on the amounts of harmful atmospheric pollutants that are emitted.

(Making Measurements of Exhaust Emissions from Vehicles More Precise)
As stated in the Fifth Report, regulations on gasoline/LPG motor vehicles and diesel motor vehicles will be greatly strengthened and target levels for exhaust emissions will be lowered. As this occurs, it is important for measurements to be reliable and to accurately understand the standards of quality that must be maintained during the manufacturing process. For this reason, it is necessary to pursue research aimed at improving measurement precision.

(Enhancing the Ability to Predict and Measure Effects)
As stated in the Fifth Report, as progress is made on vehicle measures and comprehensive vehicular exhaust emission measures, it will become increasingly important to plan and execute policies based on accurate predictions of what effect a given measure will have, and on the measurement of that effect through precise monitoring. To that end, it is necessary to compile an inventory of PM, HC, and other substances generated by all mobile emission sources (including motor vehicles), fixed emission sources (such as factories and offices), and natural emission sources. It is also necessary to get an understanding of contributions to the secondary formation of such substances as suspended particulate matter (SPM) and photochemical oxidants. Therefore, it is desirable to develop methods for predicting and measuring the effects of various policies adopted to improve the air quality, and to establish systems that will help us to grasp the effects on the roadside and at other onsite locations.

Appendix 1.

Exhaust Emission Measurement Modes Applied to Two-Wheeled Motor Vehicles

For two-wheeled motor vehicles, the mass of exhaust emissions is measured in the following manner. Fifty-five kilograms are added to the weight of the vehicle, the engine is started, and the substances contained in the exhaust generated and emitted from the exhaust pipe into the atmosphere are measured under each set of conditions cited on the left side of the table. Six measurements are made under each set of conditions, with each measurement lasting the duration specified on the right side of the table.

Operating Conditions	Time (Seconds)
Engine running without load	11
Engine accelerating from zero to 15 km/h	4
Engine running steadily at 15 km/h	8
Engine decelerating from 15 km/h to zero	5
Engine running without load	21
Engine accelerating from zero to 32 km/h	12
Engine running steadily at 32 km/h	24
Engine decelerating from 32 km/h to zero	11
Engine running without load	21
Engine accelerating from zero to 50 km/h	26
Engine running steadily at 50 km/h	12
Engine decelerating from 50 km/h to 35 km/h	8
Engine running steadily at 35 km/h	13
Engine decelerating from 35 km/h to zero	12
Engine running without load	7

Appendix 2.

Target Levels for Permissible Limits for Two-Wheeled Motor Vehicles

Category	Target Levels for Permissible Limits (Average Values)			Measurement Method
	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	
First-class motor-driven cycles	0.15 g/km	0.5 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Second-class motor-driven cycles	0.15 g/km	0.5 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Mini-sized two-wheeled motor vehicles	0.15 g/km	0.3 g/km	2.0 g/km	Measurement modes cited in Appendix 1
Small-sized two-wheeled motor vehicles	0.15 g/km	0.3 g/km	2.0 g/km	Measurement modes cited in Appendix 1

Appendix 3.

Exhaust Emission Measurement Modes Applied to Special Gasoline/LPG Motor Vehicles

For special gasoline/LPG motor vehicles, measurements are made in the following manner. The mass of substances contained in emissions from the exhaust pipe of the vehicle are measured per unit time while the vehicle is running under each condition cited on the left side of the table. Values are obtained by multiplying the results by the appropriate weighting factor shown on the right side of the table. Then the respective amounts of power generated under each of the conditions cited on the left side of the table are again multiplied by the appropriate weighting factor on the right side of the table to obtain a second set of values. The sum of the first set of values is divided by the sum of the second set of values to determine the mass of exhaust emissions per unit time and unit power.

Operating Conditions	Weighting Factor
Engine running at the speed of rated output with a full load	0.06
Engine running at intermediate speed (1) with a full load	0.02
Engine running at intermediate speed (1) with a 75% load	0.05
Engine running at intermediate speed (1) with a 50% load	0.32
Engine running at intermediate speed (1) with a 25% load	0.30
Engine running at intermediate speed (1) with a 10% load	0.10
Engine running without load	0.15

(1) When the speed at which maximum torque is generated falls 60% and 75% of the rated speed, that speed is defined as “intermediate speed.” When the speed at which maximum torque is generated is 60% of the rated speed or below, “intermediate speed” is defined as 60% of the rated speed. When the speed at which maximum torque is generated is 75% or above, “intermediate speed” is defined as 75% of the rated speed.

Appendix 4.

Target Levels for Permissible Limits for Special Diesel Motor Vehicles

Category			Target Levels for Permissible Limits (Average Values)				
			Nitrogen Oxides	Hydro-carbons	Carbon Monoxide	Particulate Matter	Black Smoke
Special Vehicles That Use Diesel Oil for Fuel	Rated output: 19 kW up to but not including 37 kW		6.0 g/kWh	1.0 g/kWh	5.0 g/kWh	0.4 g/kWh	40%
	Rated output: 37 kW up to but not including 75 kW	Rated output: 37 kW up to but not including 56 kW	4.0 g/kWh	0.7 g/kWh	5.0 g/kWh	0.3 g/kWh	35%
		Rated output: 56 kW up to but not including 75 kW				0.25 g/kWh	30%
	Rated output: 75 kW up to but not including 130 kW		3.6 g/kWh	0.4 g/kWh	5.0 g/kWh	0.2 g/kWh	25%
	Rated output: 130 kW up to but not including 560 kW		3.6 g/kWh	0.4 g/kWh	3.5 g/kWh	0.17 g/kWh	25%

Appendix 5.

Target Levels for Permissible Limits for Special Gasoline/LPG Motor Vehicles

Category		Target Levels for Permissible Limits (Average Values)			Measurement Method
		Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	
Special motor vehicles that use gasoline or liquefied petroleum gas for fuel	Rated output: 19 kW up to but not including 560 kW	0.6 g/kWh	0.6 g/kWh	20.0 g/kWh	Measurement modes cited in Appendix 3

Roster of the Experts Committee on Motor Vehicle Exhaust Emissions and Its Working Committee (Part of the Air Quality Committee of the Central Environment Council)

Member Status	Name	Affiliation	Working Committee
Chairman Special member	Michikata Kono	Dean of the Graduate School of Frontier Sciences, University of Tokyo	○
Special member	Kazuhiko Sakamoto	Dean of the Faculty of 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)	
Expert member	Masakazu Iwamoto	Professor, Chemical Resources Laboratory, Tokyo Institute of Technology	
Expert member	Matsuo Odaka	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	Yasuhiro Fukuma	Director, Japan Automobile Research Institute	
Expert member	Hidetsuru Matsushita	Professor emeritus, University of Shizuoka	
Expert member	Makoto Misono	Professor, Department of Environmental Chemical Engineering, Kogakuin University	

“Future Policy for
Motor Vehicle Exhaust Emission Reduction
(Sixth Report)” of the Central Environment Council

Press Release

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

June 30, 2003 (Monday)

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: Keiichi Ando (Extension 6550)
Deputy Director: Hidenobu Kubota (Extension 6552)

On June 30, 2003, the Air Environment Committee of the Central Environment Council (chaired by Professor Makoto Ikegami of the Faculty of Engineering, Fukui University of Technology) met and discussed the "Future Policy for Motor Vehicle Exhaust Emission Reduction (Sixth Report)." On the basis of those discussions, the chairperson of the Central Environment Council submitted a report to the Minister of the Environment that same day.

The content of the report concerns the strengthening of regulations that apply to two-wheeled motor vehicles and special motor vehicles, as summarized separately.

The Ministry of the Environment will take the necessary steps to strengthen regulations on the basis of the report.

In addition, the Central Environment Council will continue to study measures for reducing exhaust emissions from motor vehicles.

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 Exhaust 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 exhaust 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 exhaust emissions from motor vehicles, etc.

2003

April 21 — 5th meeting of the Air Environment Committee, about strengthening the regulation on two-wheeled motor vehicles

April 22 to May 21 — Public comments (two-wheeled motor vehicles) (No changes were made in content as a result of this procedure.)

June 4 — 6th meeting of the Air Environment Committee, about strengthening the regulation of special motor vehicles

June 5 to 23 — Public comments (additional edition including special vehicles) (No changes were made in content as a result of this procedure.)

June 30 — 7th meeting of the Air Environment Committee

[Sixth Report of the Central Environment Council]

- Strengthened regulations for two-wheeled motor vehicles
- Strengthened regulations for special motor vehicles

2. Discussions Held by the Experts Committee on Motor Vehicle Exhaust Emissions (After the issue of the Fifth Report)

- Experts Committee meetings held a total of 9 times
- Working Committee meetings held a total of 11 times

(Including hearings with domestic and foreign vehicle manufacturers, etc.)

* The Working Committee is a subcommittee of the Experts Committee.

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

Measures to Reduce Exhaust Emissions from Two-Wheeled Motor Vehicles

(The Need for Measures)

- Japan's atmosphere is still severely polluted by suspended particulate matter (SPM), nitrogen dioxide (NO_2) and other substances.
- Two-wheeled motor vehicles account for a high percentage (about 20%) of all hydrocarbons (HC) emitted by motor vehicles.
- Tremendous advances have been made in technologies designed to reduce exhaust emissions from gasoline-fueled motor vehicles, and it is now possible to further reduce emissions from two-wheeled motor vehicles by applying those technologies. In addition, it is anticipated that regulations governing emissions from two-wheeled motor vehicles will be strengthened in Europe and the US.

  * The reduction of HC emissions from motor vehicles is effective in reducing concentrations of NO_2, SPM and photochemical oxidants in the atmosphere, as well as reducing the emission of harmful atmospheric pollutants.

(Target Levels and Timetable)

- From 2006 to 2007, new regulations will require the following reductions compared with the target levels indicated in current regulations: HC reduced by 75 to 85%, depending on vehicle category; nitrogen oxides (NOx) reduced by 50%; and carbon monoxide (CO) reduced by 85%.
- These are the strictest target levels in the world.
- In view of the fact that two-wheeled motor vehicles account for a high percentage of total HC emissions from motor vehicles, regulations have been strengthened with an emphasis on HC reduction. Target levels for NOx and CO were set on the basis of maximum HC reductions.

  Because almost no PM is emitted, it has not been included as a target substance for regulation for some time (this is true in Europe and the US, as well).

Measures to Reduce Exhaust Emissions from Special Motor Vehicles

1. Overview

In fiscal 2000, special motor vehicles accounted for about 15% of the PM and about 32% of the NOx emitted by all motor vehicles combined. For this reason, steps have been taken to strengthen regulatory standards for special diesel motor vehicles with an emphasis on reducing PM and NOx. In addition, special gasoline/LPG motor vehicles have come under regulation for the first time.

2. Strengthening the Regulation of Special Diesel Motor Vehicles

a) From 2006 to 2008, target levels for PM and NOx will be reduced by approximately 20 to 50% for each range of rated output.

b) These target levels are the strictest in the world and are particularly stringent with regard to PM, as compared with regulations in Europe and the US.

* However, a proposal has been announced in the US that would strengthen the regulation of special diesel motor vehicles beginning in 2011, including aggressive standards that would cut PM by about 95% and NOx by about 90%.

3. Special Gasoline/LPG Motor Vehicles Are Regulated for the First Time

a) Regulations will be introduced by the end of 2007.

b) Target levels for NOx and HC will be stricter than those adopted in the US during the same period (no regulations apply in Europe).

4. Other Developments

a) Studies will be conducted regarding the introduction of regulations for special motor vehicles that do not operate on public roads (so-called “off-road vehicles.”)

b) Regulations for special diesel motor vehicles will be greatly strengthened in about 2010, premised on the use of after-treatment devices such as diesel particulate filters (DPF). Regulatory details will be the subject of future study.

New Target Levels for Reducing Exhaust Emissions

1. Two-Wheeled Motor Vehicles

Category	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	Target Year
First-class motor-driven cycle	0.15 g/km (50%)	0.5 g/km (75%)	2.0 g/km (85%)	2006
Second-class motor-driven cycle	0.15 g/km (50%)	0.5 g/km (75%)	2.0 g/km (85%)	2007
Mini-sized two-wheeled motor vehicle	0.15 g/km (50%)	0.3 g/km (85%)	2.0 g/km (85%)	2006
Small-sized two-wheeled motor vehicle	0.15 g/km (50%)	0.3 g/km (85%)	2.0 g/km (85%)	2007

* Figures in parentheses show the percentage reduction represented by the new target levels compared with existing target levels for four-stroke vehicles owned in Japan.

2. Special Diesel Motor Vehicles

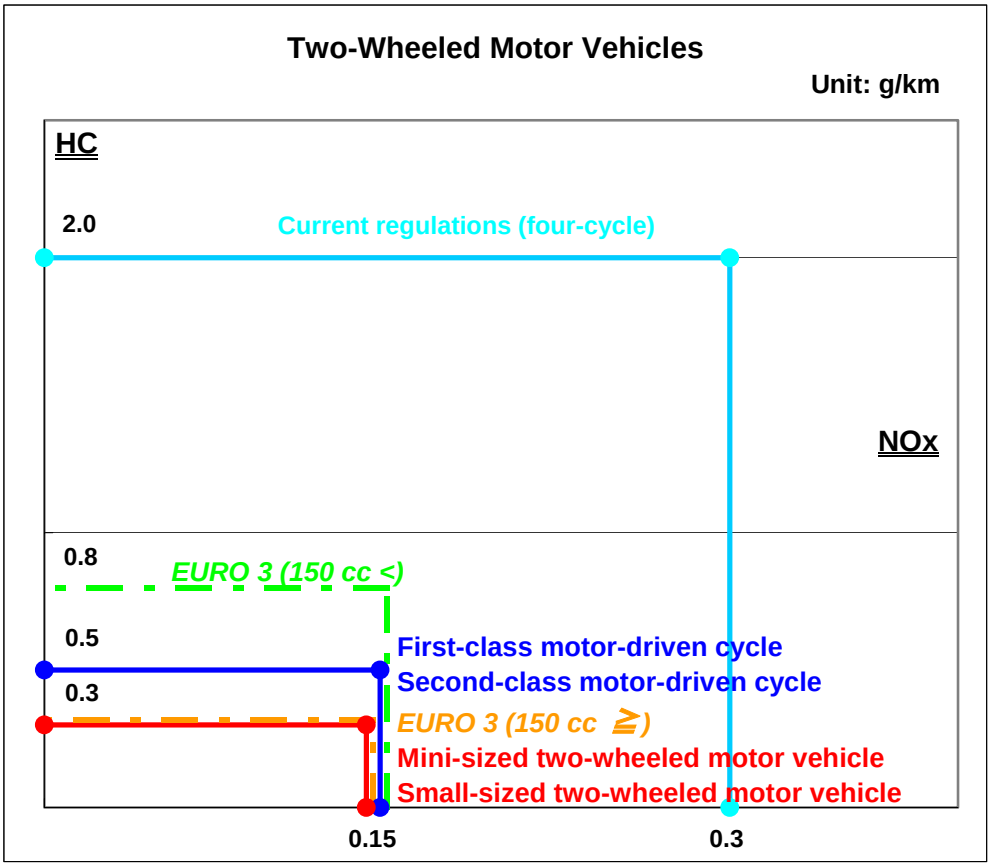
<table>
<tr><th colspan="2">Category</th><th>Nitrogen Oxides</th><th>Hydro-carbons</th><th>Carbon Monoxide</th><th>Particulate Matter</th><th>Black Smoke</th><th>Target Year</th></tr>
<tr><td colspan="2">Rated output: 19 kW up to but not including 37 kW</td><td>6.0 g/kWh (25%)</td><td>1.0 g/kWh (33%)</td><td>5.0 g/kWh (0%)</td><td>0.4 g/kWh (50%)</td><td>40%</td><td>2007</td></tr>
<tr><td rowspan="2">Rated output: 37 kW up to but not including 75 kW</td><td>Rated output: 37 kW up to but not including 56 kW</td><td rowspan="2">4.0 g/kWh (43%)</td><td rowspan="2">0.7 g/kWh (46%)</td><td rowspan="2">5.0 g/kWh (0%)</td><td>0.3 g/kWh (25%)</td><td>35%</td><td rowspan="2">2008</td></tr>
<tr><td>Rated output: 56 kW up to but not including 75 kW</td><td>0.25 g/kWh (38%)</td><td>30%</td></tr>
<tr><td colspan="2">Rated output: 75 kW up to but not including 130 kW</td><td>3.6 g/kWh (40%)</td><td>0.4 g/kWh (60%)</td><td>5.0 g/kWh (0%)</td><td>0.2 g/kWh (33%)</td><td>25%</td><td>2007</td></tr>
<tr><td colspan="2">Rated output: 130 kW up to but not including 560 kW</td><td>3.6 g/kWh (40%)</td><td>0.4 g/kWh (60%)</td><td>3.5 g/kWh (0%)</td><td>0.17 g/kWh (15%)</td><td>25%</td><td>2006</td></tr>
</table>

* Figures in parentheses show the percentage reduction represented by the new target levels compared with 2003 regulatory standards in Japan.

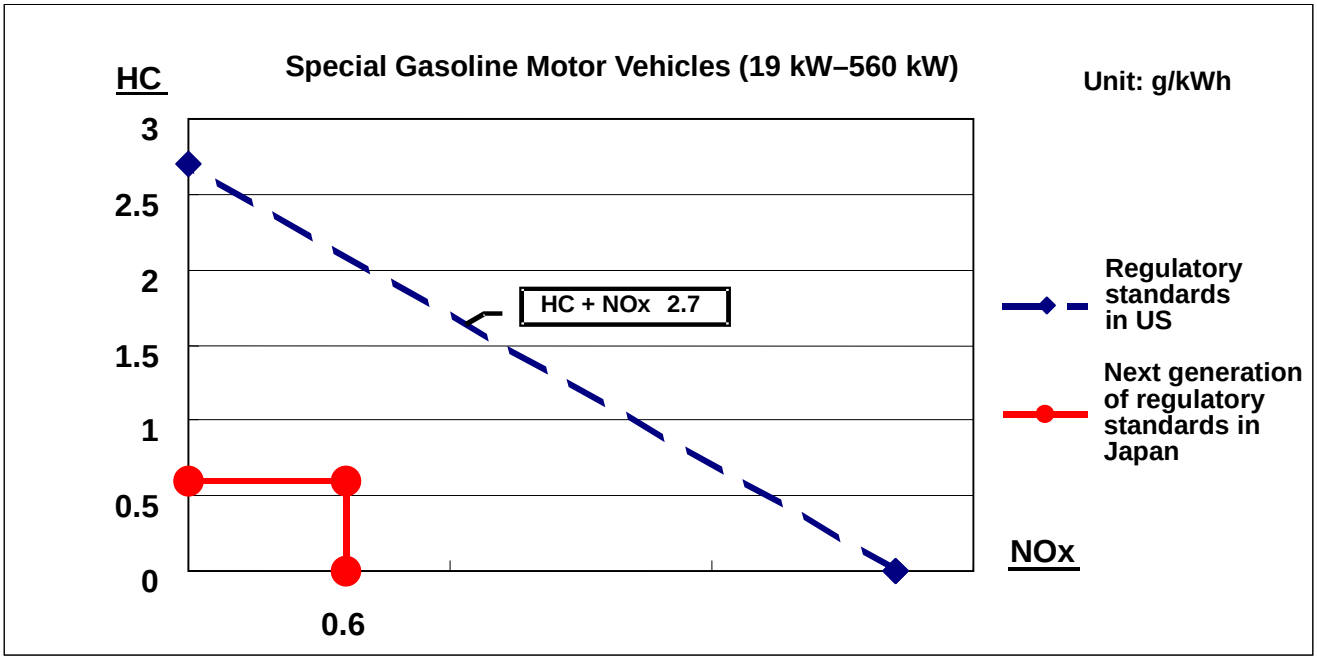
3. Special Gasoline/LPG Motor Vehicles

Category	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	Target Year
Rated output: 19 kW up to but not including 560 kW	0.6 g/kWh	0.6 g/kWh	20.0 g/kWh	2007

○ International Comparison of Regulatory Standards



* In the US, the regulatory value for 50 cc two-wheeled motor vehicles or larger is as follows: NOx + HC = 1.4 g/km (2006)



* Studies concerning the introduction of regulations are currently being conducted in Europe.

Comparisons of Regulatory Standards for Special Diesel Motor Vehicles

Unit: g/kWh