Future Policy for
Motor Vehicle Emission Reduction
(Eleventh Report)

August 10,2012

Central Environment Council

Chukanshin No. 668

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Minister of the Environment

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In response to Inquiry No. 31 of May 21, 1996, on "Future Policy for Motor Vehicle Emission Reduction", the Central Environment Council has successively made reports starting from the interim report (Chukanshin No. 83 of October 18, 1996) to the 10th report (Chukanshin No. 563 of July 28, 2010).

Of these reports, the 10th report cites, as future tasks, those related to the rethinking of the exhaust emission testing cycles, etc. of motorcycles and motor-driven cycles (hereinafter collectively referred to as "two-wheeled vehicles"), and the introduction of nitrogen oxide (NOx) after-treatment devices. Further, after the 10th report, such new issues arose as measures to be taken to reduce emissions in so-called off-cycles, or running conditions other than officially prescribed testing mode, of diesel heavy-duty vehicles and the review of black smoke regulation for non-road mobile machinery. For this purpose, the Expert Committee on Motor Vehicle Emissions discussed measures to reduce emissions from two-wheeled vehicles, diesel heavy-duty vehicles, and diesel non-road mobile machinery. In discussing measures to reduce emissions from two-wheeled vehicles and diesel non-road mobile machinery, the Committee paid special attention to reducing emissions in a way adapted to the real-world status of air quality in Japan, harmonizing these measures with international regulations, and enhancing the competition of the automobile-related industries in Japan.

The results of the discussion were compiled in the Eleventh Report by the Expert Committee on Motor Vehicle Emissions, as attached. The Air Environment Committee discussed this Eleventh Report and concluded that, in order to adequately promote the future policy for motor vehicle emission reduction, it is appropriate to adopt the Eleventh Report and reduce motor vehicle emissions as proposed therein.

The Council thus makes the following report:

1. Measures to Reduce Emissions from Two-Wheeled Vehicles

The achievement of the environmental standards on photochemical oxidants still remains at a very low level. Considering that two-wheeled vehicles discharge more emissions – in particular hydrocarbons (HC) that contribute to the production of photochemical oxidants - than gasoline – and LPG-powered motor vehicles in terms of distance traveled per vehicle, it is recommended to promote the emission reduction measures described in 1.1 to 1.3 below. These measures should be applied also to two-wheeled vehicles fueled with 10-volume percent bioethanol-blended gasoline.

1.1 Measures to reduce exhaust-pipe emissions

With regard to emission test cycles, it is recommended that, in place of the emission test cycles (two-wheeled vehicle mode) currently used, the Worldwide harmonized Motorcycle emission Test Cycle (WMTC), which was developed, with participation of Japan, at World Forum for Harmonization of Vehicle Regulations of the United Nations Economic Commission for Europe (UN-ECE/WP.29) be adopted.

The next-phase permissible limit target levels should be as indicated in Appendix and implemented by the end of 2016. Pending the implementation of the next-phase permissible limit target levels, the WMTC target levels shown in Appendix should be deemed equivalent to the target levels for the two-wheeled vehicle mode currently in force.

1.2 Measures to reduce fuel-evaporative emissions

It is recommended that measures to reduce fuel-evaporative emissions from two-wheeled vehicles be introduced. As methods to test fuel-evaporative emissions, the diurnal breathing loss test and the hot soak loss test similar to those used in the California State Test should be used. The permissible limit target level should be 2.0 g/test, which is equivalent to gasoline and LPG motor vehicles, and should be implemented by the end of 2016.

1.3 Introduction of OBD systems

It should be made mandatory that two-wheeled vehicles be equipped with onboard diagnostic (OBD) systems that monitor electrical systems for disconnection or other failures. The requirement should be implemented by the end of 2016.

1.4 Issues to be addressed in the future

Further reduction of emissions requires resolving technical problems that remain unsolved and further technical development in the future. In discussing this task, it is recommended that the government make good use of the findings from field surveys, etc. at UN-ECE/WP.29 and contribute to the development and review of international regulations, while considering harmonization with international regulations developed at UN-ECE/WP.29.

2. Measures to Reduce Emissions from Diesel Heavy-Duty Vehicles

2.1 Measures to ensure the durability and reliability of NOx after-treatment devices

It was confirmed that motor vehicles in use compliant with the New Long-Term Targets equipped with urea SCR (Selective Catalytic Reduction) systems emitted NOx exceeding regulatory limits. A urea SCR system is made of a pre-stage oxidation catalyst, an SCR catalyst, and a post-stage oxidation catalyst. Possible causes for the above-mentioned excess include the poisoning of the catalysts of the urea SCR system by HC, sulfur, phosphorus, or other metals from unburned fuel or the deterioration of catalyst performance.

To solve the problem of HC poisoning of catalysts, it is desirable to consider implementing such measures as regular heating of the urea SCR systems in in-use vehicles.

For the degradation of oxidation capacity in the pre-stage oxidation catalyst, causes other than HC poisoning are also suspected but haven't been identified yet. Hence, before discussing measures to prevent the performance degradation, further investigation should be made on its causes, such as running patterns that may cause performance degradation.

Further, considering that urea SCR systems were found to lower their performance at distance traveled less than durability distance, the current method for testing durability distance should be reviewed to consider conditions less favorable to urea SCR systems as experienced in real world.

2.2 Measures to reduce off-cycle emissions

The users of diesel heavy-duty vehicles for longer distance transportation value fuel-efficiency. Since fuel-efficiency and the amount of NOx emission trade off each other, some vehicles may choose to increase emissions in real world, while keeping emissions within regulatory limits in official test mode by electronically controlling the engine and improving fuel efficiency under running conditions other than official testing modes, including real-world running.

It is therefore recommended that the government define engine controls that deteriorate emissions from diesel heavy-duty vehicles as defeat strategies and prohibit their application, while making it clear that controls necessary only to protect engines, etc. and ensure vehicle safety as well as controls necessary only for starting and warming up the engine are not regarded as defeat strategies. For controls not regarded as defeat strategies, it is recommended that conditions under which their protection is permitted as well as requirements for enabling and disabling protection be clearly defined and, further, that their use of these controls be limited solely to cases where they are necessary to protect the engine even when they are within the limits of these requirements.

In determining whether or not a defeat strategy is used, it is appropriate to consider that the vehicle is in compliance when the fuel-efficiency actually measured at the emission test does not show a gap of more than 3% from the fuel efficiency estimated by simulation and the amount of emissions doesn't exceed the permissible target level (average) and, otherwise, regard that the vehicle uses a defeat strategy.

Further, considering that the amount of emissions significantly varies even from the same engine depending on how temperature changes with the position of the after-treatment device, it is desirable to use, in the engine bench test, conditions less favorable to the after-treatment device as experienced in real-world.

3. Measures to Reduce Emissions from Diesel Non-Road Mobile Machinery

3.1 Review of black smoke regulations

The results of the C1-mode black smoke test on diesel non-road mobile machinery compliant with the 2011 Regulation showed that their black smoke pollution level dropped to 0% thanks to DPF and other measures taken to reduce black smoke emissions. We assume that the black smoke pollution level will be kept at 0% still after reaching the 2014 Target levels. It is therefore recommended that the C1 mode black smoke test be abolished from the standpoint of rationalizing the regulatory procedures.

Further, it is recommended that the method of measuring particulate matter (PM) emissions from vehicles in use be changed from the current method using a black smoke pollution level meter to the one using an opacimeter, and that the permissible limit target level for vehicles in use be set at a light absorption coefficient of 0.5 m^{-1}. The permissible limit target levels measured with an opacimeter should be implemented from vehicles compliant with the 2014 Targets, provided, however, that, for vehicles with rated outputs of 19 kW or more up to 56

kW that maintain the permissible limit targets of 2014 from the 2011 Regulation, they should be implemented by the end of 2016.

3.2 Additional emission reduction measures for harmonization with international regulations

The worldwide harmonized regulations on the method of measuring emissions from non-road mobile machinery (NRMM) developed by UN-ECE/WP.29 in 2009 include additional measures on blow-by gas and steady-state tests.

Blow-by gas may increase as the vehicle is used and engine parts wear over time. Prohibiting diesel non-road mobile machinery from releasing the gas into the air may cause, when it works on steep sites and gets overturned, the engine oil to flow into the air intake side and the engine to run away. It is therefore recommended that, while maintaining the prohibition of blow-by gas emission in principle, vehicles that need to release blow-by gas in the air be measured not only for emissions but also for blow-by gas released in the air at the emission test, and that a permissible limit target level be set on the total amount of the two emissions.

The NRMM requires that steady-state performance be evaluated either in C1 steady-state cycle or in RMC (Ramped Modal Cycle). Considering that the amounts of emissions in C1 and RMC cycles are the same, it is recommended to introduce RMC as a steady-state test cycle and let the manufacturer choose either C1 or RMC at the emission test in type approval.

The additional blow-by gas measure and steady-state test should be implemented starting with vehicles compliant with 2014 targets. For vehicles of a rated output of 19 kW up to 56 kW, they should be implemented by the end of 2016.

4. Issues to be Addressed in the Future, etc.

The Expert Committee on Motor Vehicle Emissions will continue studying issues to be addressed in the future as listed in the Eleventh Report. Among others, the Committee will place special importance on the issues 4.1 to 4.4 discussed below. In studying these issues, it is desirable to control emissions in a way adapted to real-world running practice in Japan considering the state of air quality of the country, join activities at UN-ECE/WP.29 for harmonization of international regulations, and best harmonize domestic measures with international regulations, taking into account the stage and schedule of discussions. Furthermore, the Japanese Government should promote the measures proposed in the report, including those in 4.5.

4.1 Measures to reduce emissions from passenger cars, etc.

For motor vehicles running on gasoline, LPG, and diesel other than heavy-duty vehicles, UN-ECE/WP.29, with the participating of Japan, has been discussing a WLTP (Worldwide harmonized Light vehicles Test Procedure) including WLTC (Worldwide harmonized Light duty driving Test Cycle). It is recommended that the government continue actively taking part in the discussion and review, as the discussion progresses, the current test cycle (JC08 mode) and consider introducing WLTC. Further, it is recommended that, in the future, new permissible limit targets for emissions be set as necessary in view of the state of air pollution, passenger cars' contribution to emissions, technical developments, etc., while ensuring compatibility between low fuel-consumption technologies and emission reduction technologies.

4.2 Measures on fine particulate matters and black carbon

Japan introduced environmental standards on PM2.5 in September 2009 and has since been developing a nationwide system for measurement of PM2.5. Meanwhile, Europe introduced a regulation in 2011 that focused on the number of PM particles emitted from motor vehicles and plans to implement the regulation for diesel heavy-duty vehicles by the end of 2012. However, the current method of counting the number of PM particles has a problem that it cannot measure highly-volatile particles, which are supposed to largely contribute to PM2.5 concentration. Furthermore, black carbon, which is generated when fossil fuels burn, not only pollutes the air, but accelerates global warming as well, and has become the subject of international discussion on its actual effects and necessity of reduction. Although the black carbon is responsible for a large part of PM discharged from motor vehicles, we assume that most of it is collected before emission, now that diesel vehicles and diesel non-road mobile machinery compliant with the latest regulations on emissions are equipped with DPFs.

It is therefore recommended that the government continue faithfully implementing the PM reduction measures so far introduced, such as regulations on emissions, and, in the future, study a comprehensive policy on PM2.5, the effects of black carbons on global warming and measures to reduce the emission, and measures to be taken specifically for motor vehicles.

4.3 Measures on other non-regulated substances

As to measures on volatile organic compounds (VOC) discharged from motor vehicles, hydrocarbons and non-methane hydrocarbons (NMHC) are currently being regulated, but VOCs' effect on air pollution varies from a hydrocarbon to another. It is therefore recommended that the government study necessary measures based on information so far obtained through the development of measuring methods, improvement of measurement accuracy, and improvement of the infrastructure to measure the amount of emissions of unregulated, hazardous air pollutants from motor vehicles.

Furthermore, when, in the future, it becomes necessary to study a comprehensive policy for VOC reduction, including regulations on plants and offices, it is recommended that the government, as part of such a task, study anew measures to reduce emissions from motor vehicles and fuel standards, including their effects and future tasks.

4.4 Effects of Bio-Diesel Fuels on Emissions

Bio-diesel fuels are effective to mitigate global warming. The use of fatty acid methyl ester (FAME), among others, has been particularly popular in recent years especially in certain regions. On the other hand, on diesel vehicles, which have been so far designed for diesel oil and now provided with very sophisticated emission reduction technologies to meet increasingly stringent emission standards, the use of bio-diesel fuels may affect their emissions. It is therefore recommended that study be made on the effects of the use of bio-diesel fuels on diesel vehicles compliant with Post New Long-Term Targets and on measures to be taken based on the results of the study.

4.5 Encouragement of regular check and maintenance, and periodical vehicle inspection

It is important to continue taking necessary measures to ensure that in-use motor vehicles keep their emission reduction performance, by encouraging users to practice regular check and maintenance as well as periodical vehicle inspection prescribed in the Road Trucking Act (vehicle inspection) and by helping them check the function of emission reduction devices and check fuel quality through activities for guidance and control on streets (street inspection),

Attached Table

Permissible Limit Target Levels for Exhaust Pipe Emissions from Two-Wheeled Vehicles for 2016

		Carbon monoxides	Hydrocarbons	Nitrogen oxides
Next-phase target levels (average)	Two-wheeled vehicles of a total emission of more than 0.05o *l* but less than 0.150 *l* and a maximum speed of 50 km/h or less or two-wheeled vehicles of a total emission of less than 0.150 *l* and a maximum speed of more than 50 km/h but less than 100 km/h (Class 1)	1.14g/km	0.30g/km	0.07g/km
	Two-wheeled vehicles of a total emission of less than 0.150 *l* and a maximum speed of 100 km/h or more but less than 130 km/h, or a total emission 0.150 *l* or more and a maximum speed of less than 130 km/h (Class 2)	1.14g/km	0.20g/km	0.07g/km
	Two-wheeled vehicles of a maximum speed of 130 km/h or more (Class 3)	1.14g/km	0.17g/km	0.09g/km
Current equivalent regulatory levels (Average)	Motor-driven cycles	2.2g/km	0.45g/km	0.16g/km
	Motorcycles	2.62g/km	0.27g/km	0.21g/km