Measures to Reduce Vehicle Emissions:

The Fourth Report

Air Quality Committee
Central Environment Council

Regarding the "Measures to Reduce Vehicle Emissions in the Future" described in document No. 31 dated May 21, 1996, our committee submitted the following three reports:

(a) Interim Report: urgent measures that should be implemented to prevent harmful air pollutants (October 18, 1996).
(b) Report No. 2: measures to reduce exhaust emissions from motor vehicles that utilize gasoline or liquefied petroleum gas (LPG) as fuel, hereafter they are referred to as gasoline- or LPG-fueled motor vehicles, respectively, and also special motor vehicles, which are the large- and small-sized special motor vehicles specified in the Road Vehicle Act (November 21, 1997).
(c) Report No. 3: includes (1) the target to reduce nitrogen oxides and particulates emitted from diesel-powered motor vehicles from 2002 to 2004, which is the "new diesel short-term target," and to further reduce these pollutants by about one-half around 2007, which is the "new diesel long-term target," and (2) measures to reduce evaporative emissions from gasoline-fueled motor vehicles (December 14, 1998).

After discussing the comprehensive measures to reduce motor vehicle emissions, the Expert Committee for Motor Vehicle Exhaust Emission has finalized the attached Report No. 4. Accepting it and after full deliberation, the Air Quality Committee has come to the following conclusions:

(1) Advance the date as much as possible to attain the new diesel long-term target that is proposed in Report No. 3, and to reduce the sulfur content in diesel fuel, and
(2) Advance the date to attain the target for reducing emissions from special motor vehicles, including diesel particulates that are proposed in Report No. 2 and discuss the comprehensive measures for reducing motor vehicle emissions.

Therefore, the committee reports the followings:
1. Measures to Reduce Emissions from Diesel-Powered Motor Vehicles

(1) Advanced Implementation of the Diesel New Long-Term Target

i) Date of Implementation

Because the necessary technologies are rapidly becoming available, it seems possible to reach the new diesel long-term target by 2005, instead of the 2007 deadline shown in Report No. 3, by efficiently promoting the design, development and preparations for manufacturing exhaust aftertreatment devices. Consequently to achieve this new deadline together with the diesel new short-term regulations and the scheduled regulations for gasoline- and LPG-fueled motor vehicles, it is necessary to consider enabling the smooth introduction of those vehicles, in term of the cost and manpower increases for certification and development. If the test method is also modified and the reasonable lead-time is needed, consideration should be required for the smooth implementation of the regulations.

Although the new standard values in the diesel new long-term regulation was tentatively determined to be one-half of the new short-term standard, the values should be reconsidered because of the recent technological development. If the test method is also revised, the values should also be reconsidered. These reconsiderations should be done before the end of 2001. It is also necessary to discuss the possibility to reduce the particulates (PM) to below one-half of the new short-term standard, with the consideration of the results of risk assessment on diesel exhaust particulate (DEP). It is appropriate to enhance the early introduction of the vehicles, of which the particulate emission level will be equivalent to the new long-term standard level, following the announcement of the Japan Automobile Manufacturers Association to introduce them in the market as a voluntary-basis measures.

ii) Review of Exhaust Emission Test Methods

For the emission test method, the test cycle and method should be revised according to the required surveys, such as an on-road traffic survey. At the same time, it is necessary to reflect the Japanese city traffic condition properly to the test method. It is also necessary to endeavor to follow the ongoing international harmonization of heavy-duty engine tests, unless there is any harmful effect on Japanese environmental protection by adopting it.

In reviewing the test method, surveys and researches on reducing emissions during cold-start should be carried out appropriately. For heavy-duty vehicles in particular, introducing a test method for transient operation, i.e., the "transient mode," and a method to measure the particulate matter in that mode should both be considered.
Also a necessity of regulating non-methane hydrocarbons or non-methane organic gases (e.g., non-methane hydrocarbons plus ketone, aldehyde and other oxygenated organic compounds) should be considered. In addition, the methods to measure and regulate black smoke shall also be discussed.

(2) Measures for Fuel Quality

i) Setting the Standard for a Permissible Limit
   
   To make the emission aftertreatment devices, that are probable candidate for satisfying the diesel new long-term target, function effectively, the sulfur content of diesel fuel must be reduced. However, because of the technological limitation, it is appropriate to set the limit at 50 ppm (0.005% in mass) for the time being. In addition to the reduction of sulfate formation, it is appropriate to further reduce the fuel sulfur level to maintain the full advantage of the De-NOx catalyst that is the most promising technology to reduce NOx from the exhaust emission. It is also desirable to develop the sulfur tolerable catalyst. Further researches must also be directed towards the quantitative evaluation of the effects of aromatic content, distillation property and other fuel properties on reduction of emissions.

ii) Date of Implementation

   It is appropriate for the petroleum refiners to achieve the permissible limit value of 50 ppm in sulfur concentration of diesel fuel by the end of 2004, with the consideration of designing and modification of the refineries. As for the voluntary based early introduction of low-sulfur diesel fuel announced by the Japan Petroleum Association to meet the JAMA’s voluntary based introduction of low-emission vehicles, appropriate consolidation and construction of fuel distribution system are required to fully take the advantages of these measures. It is desirable to maintain market average of the sulfur level as low as possible.

2. Measures to Reduce Special Diesel-Powered Motor Vehicle Emissions

(1) Reaching the Target Earlier to Reduce the Emissions

   Instead of the 2004 specified in Report No. 2, reaching the target for the special diesel-powered motor vehicle emissions by 2003 can be done by earlier development of the required measures than previously assumed. For that purpose, manufactures should improve emission-testing facilities and efficiently design, develop, and prepare the relevant technologies. When introducing a regulation for the special diesel-powered motor vehicles by engine-basis emission test methods, quick adoption of an engine certification system for engine manufacturers is desirable, though the attention should be paid to the existing system.
Since the applications for certification are anticipated to increase, consideration for the smooth transition to the new regulation is necessary.

(2) Measures against Diesel Black Smoke

i) Emission Test Method

JCMAS T-004, a method to measure black smoke to certify the emission level of low-emission construction machines that are used for construction works directly controlled by the Ministry of Construction, is an appropriate test method for diesel black smoke, a part of PM. It is appropriate to adopt the test method in accordance with reaching the emission target for 2003.

Monitoring international methods for measuring black smoke should also be done. Discussing appropriate test methods to measure of black smoke emitted from general diesel-powered motor vehicles is also needed.

ii) Tentative Permissible Limit and the Date of Implementation

It is appropriate to set and achieve the permissible limit of black smoke emitted from special diesel-powered motor vehicles at 40%, which should be reached on the same date as the 2003 regulation. This permissible limit is only a tentative target: it will be reviewed according to the developments of emission reduction technologies, etc.

3. Concept of the Measures to Reduce Motor Vehicle Emissions in the Future

(1) Future Subjects

This committee will further discuss the followings additionally to the subjects described in sections 1 and 2 above.

i) The committee will set specific standard values for the diesel new long-term target as soon as possible by confirming the results of the achievement of the diesel new short-term target as well as the possibility of technological advances, the results and effects of various tests. At the same time the committee will consider the importance of PM reduction following the results of risk assessment on DEP. If the test methods are reviewed, the committee will set the standard values based on the results of the review. The committee will discuss the measures to reduce emissions during cold-start and the necessity of introducing a high-level OBD system to monitor the deterioration of performances of emission control devices.
ii) The committee will set standard values and implementation date for the new gasoline long-term target as soon as possible, after confirming the results of regulations implemented from 2000 to 2002 based on the Report No. 2, the progress of technological development, and the results and effects of various tests. The committee will discuss the measures for fuel and lubricant quality required to reach the new gasoline long-term target. These measures will be based on the results of cooperative researches promoted by the government, automobile manufacturers, and oil industry on various combinations of improved emission control technologies and fuel qualities. The committee will set the standard values based on the test method, if it has been reviewed, and discuss the revision of evaporative emission test method.

iii) The committee will discuss the necessity of reviewing the test methods for diesel-powered, gasoline- and LPG-fueled motor vehicle emissions, and the necessity of the test method itself on an early date. This will be based on results of traffic surveys and other researches needed for the revisions.

iv) The committee will discuss a new reduction target for diesel-powered motor vehicles as the necessity arises after confirming 1) the results of regulations based on the diesel new long-term target, 2) the prospect of advances in technologies, and 3) effects of various measures. The committee will discuss requirements for fuel and lubricant quality to achieve the new reduction target. This will be based on the cooperative researches promoted by the government, automobile manufacturers, and oil industry on various combinations of improved emission control technologies and fuel qualities.

v) The committee will discuss a new reduction target for two-wheeled motor vehicles as soon as the target is needed and after confirming 1) the results of the regulations implemented based on the Interim Report, 2) the prospect of advances in technologies, and 3) effects of various measures. The committee will also discuss introduction of evaporative emission standard and review the requirements for cold starts.

vi) The committee will discuss a new reduction target for special diesel-powered motor vehicles with maximum output of 19 kW to less than 560 kW when needed and after confirming 1) results of regulations that will be implemented based on this report, 2) the prospect of advances in technologies, 3) effects of various measures, and 4) after considering the changing situation in other countries.
The committee will discuss implementation of regulations for special diesel-powered motor vehicle emissions with maximum output of below 19 kW or over 560 kW for which reduction targets have not been set, and also regulations for gasoline- and LPG-fueled special motor vehicles if needed; this will be done while checking 1) the levels of air pollution, 2) changes in their proportions in overall emissions, and 3) the development of emission control technologies.

Because motor vehicles are internationally distributed commodities and the measures to reduce emissions are similar to those in other countries as is shown in Report No. 3, making the standards compatible and harmonized with those in other countries is needed to discuss and implement the above subjects, provided that they do not hold back environmental protections in Japan.

(2) Related Policies

To complement the measures in this report, the following policies should be promoted in addition to the comprehensive emission reduction measures.

**Promotion of Comprehensive Emission Reduction Measures**

Based on the review by the Joint Committee for Air Quality and Traffic Pollution Control and the Report by the Central Environment Council that will be finalized in 2000, comprehensive measures shall be planned and effectively implemented to reduce motor vehicle emissions. More specifically, the "The Low Concerning Special Measures for Total Emission Reduction of Nitrogen Oxides from Automobiles (so-called the Automobile NOx Control Law)" enacted in 1992 shall be revised to cover PM, and comprehensive measures shall be promoted to strengthen the regulations on vehicle unit measures, to improve emission reduction measures for fleet users, and to promote popularization of low-emission motor vehicles.

**Popularization of Low-Emission Vehicles**

It is necessary to promote the existing policies and to create social environments to make low-emission vehicles more popular. In 2000 March, the "Technological Guideline on the Emission from Low-Emission Vehicles" was revised based on Report No. 3 to cover trucks and buses with gross vehicle weight over 3,500 kg. According to the guidelines, promotion of low-emission motor vehicles shall be increased.

**Measures to Reduce Emissions from In-Use Motor Vehicles**

To achieve the goals in the interim report submitted by the "The Evaluation and Discussion Committee on Technological Measures for Diesel-Powered Motor Vehicles," it is urgent to discuss specific policies and measures.

As is proposed in Reports No. 2 and No. 3, good emission performance of
gasoline-fueled, LPG-fueled, and diesel-powered motor vehicles should be maintained during the in-use process by 1) inspection and maintenance at the motor vehicle inspection prescribed in the Road Vehicle Act (the "motor vehicle inspection") and 2) implementing guidance and control on streets for confirming the function of emission reduction devices (the "street control"). To assess the performance of emission reduction devices in the normal in-use process, introducing a type of sampling inspection, or surveillance, should be considered.

**Voluntary Measures in Related Industries**

The Japan Automobile Manufacturers Association and the Petroleum Association of Japan have announced that they will start marketing motor vehicles and low-sulfur diesel fuel between 2003 and 2004 to reduce PM emissions to the level to meet the diesel new long-term target. These measures should be implemented on schedule.

**Acceptance of Costs**

Promoting the measures to reduce vehicle emissions will affect engine durability and fuel consumption as well as the costs of motor vehicles, fuel and maintenance. The increased costs to use motor vehicles should be shared by motor vehicle manufactures, fuel producers, and owners of motor vehicles.

To smoothly promote changes to motor vehicles that satisfy the latest regulations and improve fuel quality, consideration shall be necessary by means of the financial aid and taxation, etc.

**Investigation and Measures against Emissions from Non-Regulated Emission Sources**

It is necessary to discuss the necessity of investigating the inventory of non-regulated emission sources and measures for them. It is also necessary to investigate and establish the systems to carry out measures.

**Measures against Global Warming**

As for environmental measures for unit vehicles, development to make the technologies for achieving low-emission and low-fuel consumption simultaneously should be promoted. As for greenhouse gases, emission inventory and generation mechanisms of carbon monoxide and N₂O should be understood, and the technology to reduce them as well as nitrogen oxides and hydrocarbons must be researched.
**Measures against Air Toxins**

To comprehensively assess the emission inventory of harmful chemicals into the environment from various sources, we suggest 1) to develop measuring methods and improve the measurement precision of harmful air pollutants emitted from motor vehicles, 2) to accumulate and improve the emission factor data. Those efforts are aided for the establishment of a basis to assess the emission from motor vehicles and implement necessary measures based on the acquired information.

It is also necessary to assess the effects of engine combustion technologies, catalysts and other methods for emission aftertreatment, and to assess the effects of qualities of fuel and lubricants on the emission of harmful air pollutants from motor vehicles.

**Improvement in Predicting and Evaluating the Effects of Measurements**

To plan and implement required policies, it will become more important to precisely predict their effects and to evaluate the effects of the measures through high-precision monitoring. Therefore, the development of methods to predict and evaluate the effects of measures on air quality improvement is desirable. Also improvement in the system for confirming the effects of measures for reducing roadside pollution is desirable.
Abbreviations (for reference)

* DEP: Diesel Exhaust Particles

Diesel exhaust particles (Particulates emitted from diesel-powered motor vehicles that are mostly in the range 0.1 to 0.3 µm in grain size when counted as mass, and in the range 0.005 to 0.05 µm in grain size when counted as the number of particles.

* LPG (Liquefied Petroleum Gas)

Liquefied petroleum gas (a mixture of propane, butane, and other substances liquefied at room temperature).

* OBD System (On-Board Diagnostic System)

On-board diagnostic system (On-board failure diagnostic device to monitor the conditions of motor vehicle).

* PM (Particulate Matter)

Particulate matter (PM) emitted from motor vehicles is broadly classified as black smoke, sulfates, and soluble organic fractions. The sulfates are the sulfuric compounds generated when sulfur in the fuel is oxidized. A large volume of sulfates is generated at heavy engine loads or with strong oxidizing catalysts. SOFs are organic substances, such as diesel fuel or unburned lubricants, from which solvents can be extracted at a relatively low boiling temperature.

* SPM (Suspended Particulate Matter)

Suspended particulate matter is particles of 10 µm or less in grain size suspended in the atmosphere, for which an environmental standard is set. SPMs are broadly classified as the primary particles that are directly emitted from emission sources, and also are the secondary particles generated through reaction or condensation of gaseous substances emitted as the primary particles.