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Motor Vehicle Standards And Regulations Around The World

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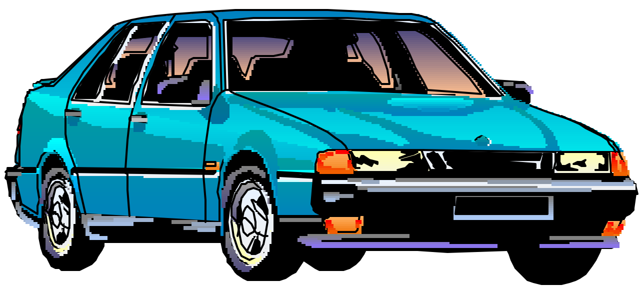

1. United States

a. Light Duty Vehicles

EMISSION STANDARDS FOR LIGHT-DUTY VEHICLES (PASSENGER CARS) AND LIGHT-DUTY TRUCKS OF UP TO 6000 LBS. GVWR

	5 Years or 50,000 Miles					10 Years or 100,000 Miles			
	NMHC	CO	Cold CO	NOx	PM	NMHC	CO	NOx	PM
Non-Diesel									
LDTs (0-3,750 LBS. LVW) and light-duty vehicles	0.25	3.4	10	0.4	-	0.31	4.2	0.6	-
LDTs (3,751-5,750 LBS. LVW)	0.32	4.4	12.5	0.7	-	0.40	5.5	0.97	-
Diesel									
LDTs (0-3,750 LBS. LVW) and light-duty vehicles	0.25	3.4	-	1.0	0.08	0.31	4.2	1.25	0.10
LDTs (3,751-5,750 LBS. LVW)	0.32	4.4	-	-	0.08	0.40	5.0	0.97	0.10

EMISSION STANDARDS FOR LIGHT-DUTY TRUCKS OF MORE THAN 6,000 LBS. GVWR

	5 Years or 50,000 Miles			10 Years or 120,000 Miles			
LDT Test Weight	NMHC	CO	NOx	NMHC	CO	NOx	PM
3,751-5,750	0.32	4.4	0.7*	0.46	6.4	0.98	0.10
Over 5,750	0.39	5.0	1.1*	0.56	7.3	1.53	0.12

Standards are expressed in grams per mile (gpm).
*Not applicable to diesel-fueled LDTs.

b. National Low Emission Vehicle (LEV) Program

On December 16, 1997, EPA finalized the regulations for the National Low Emission Vehicle (National LEV) program. Because it is a voluntary program, it could only come into effect if agreed upon by the northeastern states and the auto manufacturers. EPA has now received notifications from all the auto manufacturers and the relevant states lawfully opting into the program. As a result, starting in the northeastern states in model year 1999 and nationally in model year 2001, new cars and light light-duty trucks will meet tailpipe standards that are more stringent than EPA can mandate prior to model year 2004. Now that the program is agreed upon, these standards will be enforceable in the same manner as any other federal new motor vehicle program.

NLEV Exhaust Emission Standards (g/mi) For LDV's and LLDTs (50,000 miles)

Vehicle Type	Model Year	Fleet Average NMOG	NOX	CO
LDV and LDT (0-3750 LVW)	1999*	0.148	0.2	3.4
	2000*	0.095	0.2	3.4
	2001 and later**	0.075	0.2	3.4
LDT (3751-5750 LVW)	1999*	0.190	0.4	4.4
	2000*	0.124	0.4	4.4
	2001 and later**	0.100	0.4	4.4

* 9 Northeastern States and DC, except New York and Massachusetts
** All states except California, New York, Massachusetts, Vermont and Maine which have the California standards.

c. Tier 2

In drafting the Clean Air Act, as amended in 1990, Congress envisioned that it may be necessary to require additional emission reductions from new passenger vehicles in the beginning of the 21st Century to provide needed protection of public health. Section 202 (i) of the CAA outlines a process for assessing whether more stringent exhaust emission reductions from light-duty vehicles and light-duty trucks should be required. Congress required the Environmental Protection Agency to report the results of this assessment to Congress. Congress identified specific standards [1] that

1/ Clean Air Act; Section 202 (i); Table 3: Pending Emission Standards for Gasoline and Diesel Fueled Light-duty Vehicles and Light-duty Trucks 3,750 lbs LVW or Less.

EPA must consider in making this assessment, but stated that the study should also consider other possible standards. These standards, referred to as the "Tier 2 standards" in this study, would be more stringent than the standards required for LDVs and LDTs in the CAA beginning in model year 1994[2], but could not be implemented prior to the 2004 model year.

Specifically, Congress mandated that this study examine[3]:

1) the need for further reductions in emissions in order to attain or maintain the National Ambient Air Quality Standards, taking into consideration the waiver provisions of section 209(b).,
2) the availability of technology (including the costs thereof) in the case of light-duty vehicles and light-duty trucks with a loaded vehicle weight of 3750 lbs or less, for meeting more stringent emission standards than those provided in subsections (g) and (h) for model years commencing not earlier than after January 1, 2003, and not later than model year 2006, including the lead time and safety and energy impacts of meeting more stringent emission standards; and

3) the need for, and cost effectiveness of, obtaining further reductions in emissions from such light-duty vehicles and light-duty trucks, taking into consideration alternative means of attaining or maintaining the national primary ambient air quality standards pursuant to state implementation plans and other requirement of this Act, including their feasibility and cost effectiveness.

The National LEV program provides an additional feasibility and cost effectiveness baseline for more stringent exhaust emission standards in the future time-frame prior to that identified by Congress for the Tier 2 standards.

d. Tier 2, Low Sulfur Gasoline Proposals Released

On Saturday, May 1, President Clinton announced that the EPA proposals regarding Tier 2

Pollutant	Emission Level in grams per mile
NMHC	0.125 gpm
NOx	0.2 gpm
CO	1.7 gpm

2/ Section 202 (g) and (h).

3/ Section 202 (i), Congress specified that, "The Administrator, with the participation of the Office of Technology Assessment, shall..." However, the 104th Congress voted to cease funding the Office of Technology Assessment after September 30, 1995, prior to the Agency developing plans for the Tier 2 study.

emissions standards for light duty vehicles and low sulfur gasoline were being released for public comment.

e. Tier 2 Proposal

The program EPA is proposing would ultimately require each manufacturer's average NOx emissions over all of its Tier 2 vehicles each model year to meet a NOx standard of 0.07 g/mi. Manufacturers would have the flexibility to certify Tier 2 vehicles to different sets of exhaust standards that EPA refers to as "bins," but would have to choose the bins so that their corporate sales weighted average NOx level for their Tier 2 vehicles was no more than the 0.07 g/mi.

The program takes the corporate averaging concept and other provisions from the California Low Emissions Vehicle (LEV) program and the national NLEV program but changes the focus from NMOG to NOx. The emission standard "bins" used for this average calculation are different in several respects from those of the California LEV II program, yet EPA has designed them to allow harmonization of federal and California vehicle technology. As discussed below, the Tier 2 corporate average NOx level to be met through these requirements ultimately applies to all of a manufacturer's LDVs and LDTs (subject to two different phase-in schedules) regardless of what fuel is used.

The light duty category of motor vehicles includes all vehicles and trucks under 8500 pounds gross vehicle weight rating, or GVWR (i.e., vehicle weight plus rated cargo capacity). Table A shows the various light duty categories. In the discussion below, EPA makes frequent reference to two separate groups of light vehicles: (1) LDV/LLDTs, which include all LDVs and all LDT1s and LDT2s; and (2) HLDTs, which include LDT3s and LDT4s.

Table A
Light Duty Vehicles and Trucks; Category Characteristics

	Characteristics
LDV	A passenger car or passenger car derivative seating 12 passengers or less
Light LDT (LLDT)	Any LDT rated at up through 6,000 lbs GVWR. Includes LDT1 and LDT2
Heavy LDT (HLDT)	Any LDT rated at greater than 6,000 lbs GVWR, but not more than 8,500 lbs GVWR. Includes LDT3 and LDT4

The Tier 2 program would take effect in 2004, with full phase in occurring by 2007 for LDV/LLDTs and 2009 for HLDTs. During the phase-in years of 2004-2008, vehicles not certified to Tier 2 requirements would meet interim requirements that would also employ a bins system, but with less stringent corporate average NOx standards.

i. Tier 2 Emission Standard "Bins"

EPA is proposing seven emission standard bins, each one a set of standards to which

manufacturers could certify their vehicles. (Tables B and C. below show all the standards associated with each bin.) Several bins have the same values as the California LEV II program. Further, EPA added three bins that are not a part of the California program to increase the flexibility of the program for manufacturers. EPA believes these extra bins would help provide incentives for manufacturers to produce vehicles with emissions below 0.07 g/mi NOx.

Table B
Tier 2 Light-Duty Full Useful Life (120,000 mile) Exhaust Emission Standards
(grams per mile)

Bin Number	NOx	NMOG	CO	HCHO	PM
7	0.2	0.125	4.2	0.018	0.02
6	0.15	0.09	4.2	0.018	0.02
5	0.07	0.09	4.2	0.018	0.01
4	0.07	0.055	2.1	0.011	0.01
3	0.04	0.07	2.1	0.011	0.01
2	0.02	0.01	2.1	0.004	0.01
1	0	0	0	0	0

Table C
Light-Duty Intermediate Useful Life (50,000 mile) Exhaust Emission Standards
(grams per mile)

Bin Number	NOx	NMOG	CO	HCHO	PM
7	0.14	0.1	3.4	0.015	----
6	0.11	0.075	3.4	0.015	----
5	0.05	0.075	3.4	0.015	----
4	0.05	0.04	1.7	0.008	----

Under a “bins” approach, a manufacturer may select a set of emission standards (a bin) to comply with, and a test group must meet all standards within that bin.

In addition to the Tier 2 standards described above, EPA is also proposing interim standards derived from the LDV/LDT1 NLEV standards to cover all non-Tier 2 LDVs and LLDTs during the Tier 2 phase-in. EPA is proposing separate interim standards for HLDTs.

The focus on NOx allows NMOG emissions to “float” in that the fleet NMOG emission rate depends on the mix of bins used to meet the NOx standard. However, one can see by examining the bins

EPA is proposing, that any combination of vehicles meeting the 0.07 g/mi average NOx standard would have average NMOG levels at or below 0.09 g/mi. In addition, there will be overall improvements in NMOG since Tier 2 incorporates HLDTs, which are not covered by the NLEV program.

ii. Schedules for Implementation

EPA concludes that the Tier 2 standards pose greater technological challenges for larger light duty trucks than for LDVs and smaller trucks. Therefore, it believes that additional lead time is appropriate for HLDTs. HLDTs have historically been subject to the least stringent vehicle-based standards. Also, HLDTs were not subject to the voluntary emission reductions implemented for LDVs, LDT1s and LDT2s in the NLEV program. Consequently EPA has designed separate phase-in programs for the two groups. It would provide HLDTs with extra time before they would need to begin phase-in to the Tier 2 standards and also provide two additional years for them to fully comply. Figure I provides a graphical representation of how the phase-in of the Tier 2 program would work for all vehicles. This figure shows several aspects of the proposed program:

- phase-in/phase-out requirements of the interim programs;
- phase-in requirements of new evaporative standards;
- years that could be included in alternative phase-in schedules;
- years in which manufacturers could bank NOx credits through “early banking”; and
- “boundaries” on averaging sets in the Tier 2 and interim programs.

Figure I

TIER 2 AND INTERIM NON-TIER 2 PHASE-IN AND EXHAUST AVERAGING SETS

(Bold lines around shaded areas indicate averaging sets)

	2001	2002	2003	2004	2005	2006	2007	2008	2009 & later	NOx STD. (g/mi)
LDV/LLDT (INTERIM)	NLEV	NLEV	NLEV	75% max.	50% max.	25% max.				0.30 avg
LDV/LLDT (TIER 2 +evap)	*early banking* [b]			25%	50%	75%	100%	100%	100%	0.07 avg
HLDT (TIER 2 +evap)	[b]	[b]	[b]	*early banking* [b]				50%	100%	0.07 avg
HLDT (INTERIM)	TIER 1 [b]	TIER 1 [b]	TIER 1 [b]	25%	50%	75%	100%	50% max.		0.20[a] avg

[a] 0.60 NOx cap applies to balance of vehicles during the 2004-2006 phase-in years

[b] Alternative phase-in provisions permit manufacturers to deviate from the 25/50/75% 2004-2006 and 50% 2008 phase-in requirements and provide credit for phasing in some vehicles during one or more of these model years.

iii. Implementation Schedule for LDVs and LLDTs.

EPA is proposing that the Tier 2 standards take effect beginning with the 2004 model year for light duty vehicles and trucks at or below 6000 pounds GVWR (LDV/LLDTs). EPA is proposing that manufacturers would phase their vehicles into the Tier 2 program beginning with 25 percent of LDV/LLDT sales that year, 50 percent in 2005, 75 percent in 2006, and 100 percent in 2007. Manufacturers would be free to choose which vehicles were phased-in each year. However, in each year during (and after) the phase-in, the manufacturer's average NOx for its Tier 2 vehicles would have to meet the 0.07 g/mi corporate average standard. This phase-in schedule would provide between five and eight years of lead time for the manufacturers to bring all of their LDV/LLDT production into compliance. These vehicles constitute nearly 90 percent of the light duty fleet.

iv. Implementation Schedule for HLDTs.

To provide greater lead time for HLDTs EPA is proposing that the Tier 2 phase-in schedule would start later and end later than that for LDVs and LLDTs. In its proposal 50 percent of each manufacturer's HLDTs would be required to meet Tier 2 standards in 2008, and 100 percent would have to meet Tier 2 standards in 2009. As with the LDV/LLDTs, the Tier 2 HLDTs would have to meet a corporate average NOx standard of 0.07 g/mi. This delayed phase-in schedule would provide manufacturers with nine years of lead time before they would need to bring any HLDTs into compliance with Tier 2 standards.

v. LDVs and LDTs Not Covered by Tier 2

The two groups of vehicles (LDV/LLDTs and HLDTs) will be approaching the Tier 2 standards from quite different emission "backgrounds." LDV/LLDTs will be at NLEV levels, which require NOx emissions of either 0.3 or 0.5g/mi on average[4], while HLDTs will be at Tier 1 levels facing NOx standards of either 0.98 or 1.53 g/mi, depending on truck size. These Tier 1 NOx levels for HLDTs are very high relative to its 0.07 g/mi Tier 2 NOx average. To address the disparity in emission "backgrounds" while gaining air quality benefits from vehicles during the phase-in period, EPA is proposing separate sets of interim standards for the two vehicle groups during the phase-in period. The provisions described below would apply in 2004 for all LDVs and LDTs not certified to Tier 2 standards.

vi. Interim Standards for LDV/LLDTs.

Beginning with the 2004 model year, all new LDVs and LLDTs not incorporated under the Tier 2 phase-in would be subject to an interim corporate average NOx standard of 0.30 g/mi. This is the nominal LEV NOx emission standard for LDVs and LDT1s under the NLEV program. This interim program would hold LDVs and LLDTs not covered by the Tier 2 standards during the phase-in to NLEV levels and bring about NOx emission reductions from LDT2s . By implementing these interim standards for LDVs and LLDTs EPA hopes to ensure that the accomplishments of the NLEV programs are continued. Because the Tier 2 standards are phased-in beginning in the 2004 model

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4/ The NLEV program imposes NMOG average standards that would lead to full useful life NOx levels of about 0.3 g/mi for LDV/LDT1s and 0.5 g/mi for LDT2s.

year, the interim standards for LDVs and LLDTs apply to fewer vehicles each year, i.e., they are "phase-out" standards.

vii. Interim Standards for HLDTs.

EPA's interim standards for HLDTs would begin in 2004. The Interim Program for HLDTs would set a corporate average NOx standard of 0.20 g/mi that would be phased in between 2004 and 2007. The interim HLDT standards, like those for LDV/LLDTs would be built around a set of bins (See Tables D and E).

Table D
Full Useful Life (120,000 mile) Interim Exhaust Emission Standards for HLDTs
(grams per mile)

Bin Number	NOx	NMOG	CO	HCHO	PM
5	0.6	0.23	4.2	0.018	0.06
4	0.3	0.18	4.2	0.018	0.06
3	0.2	0.156	4.2	0.018	0.02
2	0.07	0.09	4.2	0.018	0.01
1	0	0	0	0	0

Table E
Intermediate Useful Life (50,000 mile) Interim Exhaust Emission Standards for HLDTs
(grams per mile)

Bin Number	NOx	NMOG	CO	HCHO	PM
5	0.4	0.16	3.4	0.015	-----
4	0.2	0.14	3.4	0.015	-----
3	0.14	0.125	3.4	0.015	-----
2	0.05	0.075	3.4	0.015	-----

The phase-in would be 25 percent in the 2004 model year, 50 percent in 2005, 75 percent in 2006, and 100 percent in 2007. The program would remain in effect through 2008 to cover those HLDTs not yet phased into the Tier 2 standards (a maximum of 50%). Vehicles not subject to the interim corporate average NOx standard during the 2004-2006 phase-in years would be subject to the least stringent bin (Bin 5) so their NOx emissions would be effectively capped at 0.60 g/mi. These vehicles would be excluded from the calculation to determine compliance with the interim 0.20 g/mi average NOx standard.

This proposed approach would allow more time for manufacturers to bring the more difficult HLDTs to Tier 2 levels while achieving real reductions from those HLDTs that may present less of a challenge.

viii. Interim Programs Would Provide Reductions over Previous Standards

As was the case with the primary Tier 2 bin structure, the bin structure for the interim programs would focus on NOx and yet should provide further reductions in NMOG beyond the NLEV program. This is because the interim programs would reduce emissions from LDT2s and HLDTs compared to their previous standards. Without the interim standards, HLDTs could be certified as high as 0.46 g/mi or 0.56 g/mi, the Tier 1 NMHC levels. With the interim standards, however, exhaust NMOG should average approximately 0.09 g/mi for all non-Tier 2 LDV/LLDTs. and 0.25 g/mi or less for HLDTs.

ix. Alternative Approach for Interim Standards.

An alternative flexible approach for reducing the emissions from vehicles and trucks prior to their phase-in to Tier 2 standards would be to employ a declining NOx average, or perhaps separate declining NOx averages for LDV/LLDTs and HLDTs. In this approach, manufacturers would certify vehicles to their choice of bins, but would have to meet an average NOx standard (or standards) that became lower each year. Manufacturers could bank NOx credits in early years of such a program for use in later years when the standard tightened.

x. Generating, Banking, and Trading NOx Credits

As described above, EPA is proposing that manufacturers average the NOx emissions of their Tier 2 vehicles and comply with a corporate average NOx standard. In addition, EPA is proposing that when a manufacturer's average NOx emissions fall below the corporate average NOx standard, it could generate NOx credits that it could save for later use (banking) or sell to another manufacturer (trading). NOx credits would be available under the Tier 2 standards, the interim standards for LDVs and LLDTs, and the interim standards for HLDTs. These NOx credit provisions would facilitate compliance with the fleet average NOx standards and would be very similar to those currently in place for NMOG emissions under California and federal NLEV regulations.

A manufacturer with an average NOx level for its Tier 2 vehicles in a given model year below the 0.07 gram per mile corporate average standard would generate Tier 2 NOx credits that it could use in a future model year when its average NOx might exceed the 0.07 standard. Manufacturers would calculate their corporate average NOx emissions and then compute credits based on how far below 0.07 g/mi the corporate average fell.

Manufacturers would be free to retain any credits they generate for future use or to trade (sell) those credits to other manufacturers. Credits retained or purchased could be used by manufacturers with corporate average Tier 2 NOx levels above 0.07 g/mi. Manufacturers could certify LDVs and LLDTs to Tier 2 standards as early as the 2001 model year and receive NOx credits for their efforts. They could use credits generated under these "early banking" provisions after the Tier 2 phase-in begins in 2004 (2008 for HLDTs).

Banking and trading of NOx credits under the interim non-Tier 2 standards would be similar, except that a manufacturer would determine its credits based upon the 0.30 or 0.20 gram per mile corporate average NOx standard applicable to vehicles in the interim programs. There would be no provisions for early banking under the interim standards and manufacturers would not be allowed to use interim credits to address the Tier 2 NOx average standard. Interim credits from LDVs/LLDTs and interim credits from HLDTs could not be used interchangeably due to the differences in the interim corporate average NOx standards.

xi. Considerations for a 2004 Technology Review

EPA is seeking comment on whether it should conduct a technology review of the Tier 2 standards in the future. As part of the input received from stakeholders while developing this proposal, the Alliance of Automobile Manufacturers suggested that the proposal include consideration of a technology review, principally designed to assess the status of Tier 2 technology development. Some manufacturers have suggested that the approach of applying the same standard to cars and light-duty trucks presents sufficient challenge as to raise serious uncertainty about compliance for the larger vehicles, even in the 2008 time frame. In addition to the concerns expressed regarding the time frame for implementation of the more stringent standards for HLDTs in 2008, manufacturers have indicated that there are questions of feasibility for introduction of advanced technologies for improved fuel economy, such as lean burn, fuel cell, and hybrid electric technology.

The review could assess the feasibility of the standards relative to the state of technology development for HLDTs. Further, the review could consider gasoline and diesel fuel quality and its impact on the effectiveness of aftertreatment, and whether lower sulfur levels are necessary for HLDTs to meet the Tier 2 standards. EPA may also examine the feasibility of the standards for vehicles using technologies to advance fuel economy. In addition, the review could consider whether additional air quality improvements are necessary and the feasibility of additional reductions of vehicle emissions to achieve such air quality improvements. EPA believes that serious consideration of this concept is warranted and if it determines such a review to be appropriate, the best time to conduct such a review may be in the 2004 time frame, before the final Tier 2 standards go into effect for HLDTs.

EPA could conduct such a review to assess the feasibility, timing and stringency of the standards relative to the state of technology development. In doing so, EPA would determine whether or not there was a need to formally consider a change in the final Tier 2 standards. If such a change were determined to be necessary, EPA would conduct a formal Rulemaking, including conducting public hearings.

As part of the technology review, EPA would seek advice from all appropriate stakeholders and could engage a peer review process. In addition, such a process, if undertaken, could include public notice and opportunity for comment on the review, including the holding of public hearings by EPA. One way to structure the process would include the establishment of an advisory panel under the Clean Air Act Advisory Committee to provide assessment of the state of technology and the feasibility of the standards. The Committee could recommend appropriate action for the Administrator based on their findings. The Administrator would then determine if any changes were

needed to adjust the Tier 2 standards for HLDTs, advanced technologies, or the fuel parameters. EPA requests comment on the need for a technology review, scope of the review and on the design of the process and its timing.

xii. Primary Phase-In Schedule

EPA is proposing to phase in the Tier 2 standards for LDVs/LLDTs over a four year period beginning in 2004 and EPA is proposing a delayed two year phase-in beginning in 2008 for HLDTs. These phase-in schedules are shown in Tables E and F. In each year, manufacturers would have to ensure that the specified fraction of their U.S. sales[5] met Tier 2 standards for evaporative emissions and exhaust emissions, including Supplemental Federal Test Procedure (SFTP) standards, as well as the corporate average Tier 2 NOx standard. Manufacturers would have to meet the Tier 2 exhaust requirements (i.e., all the standards of a particular bin plus the SFTP standards) using the same vehicles. Vehicles not covered by the Tier 2 standards during the phase-in years (2004-2008) would have to meet interim standards and the existing evaporative emission as well as the applicable SFTP standards.

Table E
Primary Phase-in Schedule for Sales of Tier 2 LDVs and LLDTs

Model Year	Required Percentage of Light-Duty Vehicles and Light Light-Duty Trucks
2004	25%
2005	50%
2006	75%
2007	100%

Table F
Primary Phase-in Schedule for Sales of Tier 2 HLDTs

Model Year	Required Percentage of Heavy Light-Duty Trucks
2008	50%

5/ For Tier 2 vehicles (and for interim vehicles), the term "U.S. sales" means, for a given model year, those sales in states other than California and any states that have adopted the California program.

2009	100%

xiii. Less Stringent In Use Standards

For the first two years, the in use standards for vehicles in bins 2,3,4 and 5 will be relaxed as shown in Table G, below.

Table G
In Use Standards For Tier 2 Vehicles

Bin	Durability (miles)	NOx	NMOG
54	50000	0.07	n/a
54	120000	0.1	n/a
3	120000	0.06	n/a
2	120000	0.03	n/a

xiv. Evaporative Standards

Evaporative standards will be reduced by 50%.

xv. Costs

EPA estimates that the costs will be about $100 for light duty vehicles and light light trucks and $200 for the heavier trucks.

f. Gasoline Sulfur Proposal

EPA is proposing to require substantial reductions in gasoline sulfur levels nationwide. Not only would these standards enable the stringent tailpipe emission standards EPA is proposing for Tier 2 vehicles and ensure that these low emission levels would be realized throughout the life of the vehicle, but they would also help to reduce emissions of pollutants that endanger public health and welfare from vehicles already on the road, including NLEV vehicles. The following sections summarize the proposed requirements for gasoline refiners and importers, special provisions for small refiners, and possible changes to construction permitting requirements that would enable refiners to install gasoline desulfurization technology in a timely manner. EPA also raises the potential need for changes to diesel fuel to enable diesel technologies to meet the proposed Tier 2 standards.

i. Standards for Refiners and Importers

EPA's proposed gasoline sulfur program balances the goal of enabling Tier 2 emission control

technologies with the goal of lowering sulfur as early as the refining industry can practically achieve the required levels. To accomplish both of these goals, EPA is proposing a set of standards combined with a sulfur averaging, banking, and trading (ABT) program. This proposed overall program would achieve the desired sulfur levels, on average, beginning in 2004 - the first year Tier 2 vehicles will be sold - while proposing to allow the use of credits towards compliance with refinery average standards indefinitely (within the limits of per-gallon caps). These requirements would apply to all gasoline sold in the U.S.,[6] based on EPA's belief that emissions must be reduced nationwide to adequately protect public health and the environment and that Tier 2 vehicles operated everywhere in the U.S. require protection from the harmful impacts of gasoline sulfur.

Table H presents the proposed standards for gasoline refiners and importers. The proposal would require all gasoline refiners and importers to produce gasoline that meets an average standard of 30 ppm sulfur at the refinery gate on an annual basis, beginning in 2004. These requirements would apply to all gasoline, reformulated as well as conventional. In 2004 and beyond this standard could be met through the use of credits generated as early as 2000 by refiners who substantially reduce sulfur levels from current (1997-1998) levels, under the provisions of the proposed sulfur ABT program. Hence, the actual average sulfur levels for gasoline in use could be somewhat higher than 30 ppm. However, to ensure that sulfur levels are being reduced significantly (for the benefit of Tier 2 vehicles and to achieve the other emissions benefits of reducing gasoline sulfur), these in-use sulfur levels would be constrained by maximum corporate pool average standards of 120 ppm in 2004 and 90 ppm in 2005. These standards would represent the maximum allowable average sulfur levels for each refiner, measured across all refineries owned and operated by that refiner, rather than at each refinery. In 2006 and beyond, there would be no corporate pool average standard. Every refinery would have to meet the 30 ppm average refinery gate standard, although refiners could use any banked/purchased credits to meet this standard. Thus, in 2006 and beyond, the majority of gasoline would average 30 ppm, although some individual refineries could average slightly more or less.

Table H
Proposed Gasoline Sulfur Standards for Refiners and Importers
(Excluding Small Refiners)

Compliance as of:	**37986**	**38352**	**January 1, 2006+**
Refinery Average, ppm	30[a]	30[a]	30[a]
Corporate Pool Average, ppm	120	90	not applicable
Per-Gallon Cap, ppm	300[b]	180	80

[a] This standard can be met through the use of credits as long as the applicable corporate pool average and per-gallon caps are not exceeded, as explained in the text.
[b] This initial per-gallon cap standard begins October 1, 2003.

6/ Gasoline sold in California that meets California's standards would be exempt from meeting the proposed standards, due to EPA's belief that California gasoline already meets or exceeds these requirements. See Section VI.B.

To ensure that, even as average sulfur levels are reduced in 2004-2006, gasoline sulfur levels do not exceed a maximum level that EPA believes is particularly harmful to Tier 2 vehicles, EPA is also proposing "caps" on the sulfur content of every batch of gasoline produced or imported into the country. As shown in Table H, these caps decline over time, ultimately resulting in a per-gallon limit of 80 ppm in 2006 and beyond. Since Tier 2 vehicles would be sold prior to the start of calendar year 2004, the actual date when the initial sulfur cap standard would take effect at the refinery is October 1, 2003. EPA is also proposing caps on the sulfur content of gasoline sold at the retail level or otherwise distributed downstream of the refinery.

ii. How Did EPA Arrive At the 80 ppm Cap and 30 ppm Average Standards?

EPA believes a 30 ppm averaging standard is important and necessary to enable the emission reductions needed from Tier 2 vehicles. The test data EPA has reviewed show that even very low levels of sulfur have some negative impact on catalyst performance. Most of the data available to EPA were generated through testing with minimum sulfur levels near 30 ppm. EPA has used this data to conclude that sulfur levels need to be reduced, and to assess, as part of EPA's analysis, the technical feasibility of the proposed Tier 2 vehicle standards. The non-linear relationship between sulfur level and emissions impact (the lower the sulfur level, the greater the incremental increase in emissions) suggests that emission reductions would be ensured by sulfur levels at or near 30 ppm. EPA believes that requiring the 30 ppm average standard would be necessary to ensure that vehicles regularly use gasoline containing very low amounts of sulfur, regardless of where the vehicles were driven, what time of year it was, or how gasoline production varied from batch-to-batch in a given refinery.

EPA also believes that an 80 ppm cap standard would be required to provide appropriate insurance for maintaining Tier 2 standards in use and to give automakers an indication of the maximum sulfur levels for which they would need to design their vehicles. The test data EPA has reviewed show that the greatest increase in emissions comes as the sulfur level is increased from the lowest levels (i.e., 30 ppm). At higher sulfur levels (i.e., above 100 ppm), the catalyst performance is impaired to the extent that an additional increase in sulfur content has a smaller additional impact on emissions. Since the factors that influence sulfur sensitivity vary from vehicle to vehicle, different vehicles will experience different impacts from exposure to specific sulfur levels. None of the data that EPA has reviewed indicates that a vehicle can be designed to be completely insensitive to sulfur for all types of emissions. Furthermore, EPA's concern that roughly half of the sulfur impact on the catalyst would be irreversible for Tier 2 vehicles (with other vehicles being negatively affected as well) provides additional arguments for trying to keep the sulfur cap as close to the average as possible. Hence, to ensure that Tier 2 vehicles maintain the designed emission performance over the life of the vehicle, EPA believes a cap on gasoline sulfur levels would be necessary, and that 80 ppm would be the appropriate level for this cap.

Setting a cap also would enhance enforcement of sulfur standards by setting a maximum level of sulfur that could be checked at all points in the gasoline distribution process. A sulfur cap significantly lower than 80 ppm could have the unintended consequence of forcing a sulfur average lower than the 30 ppm standard, increasing the overall costs of the program. The proposed level of 80 ppm sulfur for the cap reflects EPA's balancing of several factors, including the potential air

quality benefits, economic impacts, compliance flexibility, and the irreversibility of the effects of gasoline sulfur on vehicle emission controls.

EPA believes that the combination of EPA's proposed gasoline sulfur standards and the proposed Tier 2 standards would be cost-effective. This judgement about cost-effectiveness reflects what EPA believes would be an appropriate balance between the costs to be borne by the affected industries and the emissions reductions to be gained. Even though few refiners currently produce gasoline at or near these levels, there appear to be no significant obstacles to refiners achieving this level of sulfur control by 2004 (or 2006 if they were to take advantage of the sulfur ABT program). Unless a substantially higher average sulfur standard were set or a substantially smaller fraction of gasoline were affected by EPA's regulations, refiners would have to make a significant investment in technology to desulfurize gasoline. Hence the cost to refiners would not be substantially reduced if EPA selected a less stringent average standard. Furthermore, EPA believes that a lesser reduction in gasoline sulfur levels could require EPA to reduce the stringency of the proposed Tier 2 standards. A higher average sulfur level would require less stringent standards or more vehicle hardware costs; either would reduce the effectiveness of EPA's proposed combined program.

At the same time, EPA recognizes the need to provide some flexibilities to refiners in meeting EPA's proposed standards, to ensure that the program is implemented in an orderly manner, without severe consequences in the initial months (for example, supply shortages or substantial spikes). Hence, EPA has proposed to allow less stringent caps in 2004 and 2005 (through 2007 under the small refiner provisions discussed below) to balance the needs of the technology with the regulatory burden, economic impact, and ability of the refining industry to reduce sulfur levels in this time frame. Given that Tier 2 vehicles would be phased in over several years and that the vast majority of gasoline would be capped at 80 ppm by 2006 (when 75% of new LDV, LDT1, and LDT2 sales would be required to meet the proposed Tier 2 standards), EPA believes that the potential damage to Tier 2 catalysts would be minimized. Furthermore, since the gasoline distribution system is fungible (i.e., gasoline from multiple refiners may be mixed together, and gasoline produced at one company's refinery may be sold at another company's retail station), any gasoline that approached the higher caps in 2004 and 2005 would be highly likely to be diluted by lower sulfur gasoline, further limiting the potential negative impact on Tier 2 vehicles.

EPA has also proposed to permit compliance with the 30 ppm refinery average with the use of credits indefinitely, not just in the years during which the corporate average is reduced, as long as the applicable per-gallon caps are not exceeded.

In light of EPA's technical conclusions about the need for these standards, and EPA's concerns about the irreversibility of the sulfur effect, EPA believes the 30 ppm average/80 ppm cap is the appropriate sulfur level to enable vehicles to meet the proposed Tier 2 standards and to maximize the emissions reductions to be achieved from this program in a cost-effective way.

iii. Should a Near-Zero Gasoline Sulfur Standard Be Considered?

The auto industry, represented by the Alliance of Automobile Manufacturers, have supported a gasoline sulfur control program that would require 30 ppm gasoline in 2004 with a further reduction to "near-zero" levels (less than 5 ppm) by 2007. They believe that near-zero sulfur levels would

enable the emission control technology that would ultimately be necessary to meet standards similar to those EPA is proposing today. They also believe that very low sulfur gasoline would significantly increase the emission reductions of the program as compared to a 30 ppm sulfur program.

EPA is also aware of concerns that advanced emission control and fuel efficient technologies, such as gasoline direct injection engines and automotive fuel cells, may require zero or near-zero sulfur levels to achieve Tier 2 emission levels over their full useful life (or in some cases, even to operate for a significant length of time). At the same time, EPA is aware that there may be technological solutions to these problems that may allow these technologies to operate on gasoline averaging 30 ppm sulfur. For example, it may be possible to regenerate (remove the sulfur from) the emission control technologies used by gasoline direct injection engines on an ongoing basis. Similarly, it may be possible to prevent sulfur from entering a fuel cell through the use of a sulfur "guard" made, for example, of zinc oxide, that might need to be replaced periodically.

EPA believes at this time that EPA's proposed Tier 2 standards could be met with conventional technology if gasoline averaging 30 ppm is available. Nonetheless, for the reasons put forward by the auto industry and others, EPA also believes that it may be desirable in the long term for all gasoline in the U.S. to average substantially below 30 ppm sulfur.

iv. Why Is EPA Proposing Less Stringent Standards for 2004 and 2005?

EPA is proposing to permit corporate average sulfur levels to be somewhat higher than 30 ppm, and maximum sulfur levels to be higher than 80 ppm, under the ABT program in 2004 and 2005. This proposal is meant to provide greater flexibility for refiners to meet EPA's ultimate goal of the 30 ppm standard in an orderly fashion, while limiting the negative environmental consequences. The temporary nature of the ABT program would ensure that any negative consequences for Tier 2 vehicles of these higher sulfur levels (120 ppm average in 2004, 90 ppm in 2005) would be minimal. By the time that the majority of new vehicles sales would be required to meet the Tier 2 standards (2006 and beyond), average sulfur levels in gasoline would meet the 30 ppm annual average standard.

EPA has proposed per-gallon caps of 300 ppm in 2004 and 180 ppm in 2005 at the refinery gate, with slightly higher caps imposed downstream. EPA believes that downstream caps would be necessary to ensure compliance and protect Tier 2 vehicles. At the same time, EPA believes caps at the refinery gate would be necessary to guarantee that the environmental goals of this program were met; the corporate and refinery averages alone wouldn't provide the full emissions reductions and environmental benefits EPA has estimated because, by themselves, they could allow gasoline with high sulfur levels in the system as long as the refiner offset any such high sulfur batches with very low sulfur gasoline. However, there are some arguments for eliminating the per-gallon standard at the refinery gate and simply enforcing a per-gallon cap at the retail level (or some intermediate point downstream). This approach would give refiners and blenders greater flexibility in blending occasional batches of gasoline that exceed the proposed cap standards. These refiners/blenders could sell and transport these high sulfur batches to another party who would blend down the sulfur level to make gasoline meeting the downstream caps. One shortcoming of such an approach (removing the per-gallon cap at the refinery) is that not all gasoline passes

through multiple parties before ending up at the retail level; some refiners ship part or all of their production directly from refinery to retail outlet.

v. Costs

EPA estimates that the overall cost to reduce the sulfur will be less than $0.02 per gallon or approximately $100 over the life of the typical vehicle.

g. Advance Notice on Diesel Sulfur

While not a formal proposal, EPA has requested comments on setting more stringent sulfur limits for diesel fuel. EPA did not suggest a particular limit but cited the vehicle and engine manufacturers' call for a 30 ppm cap in the short term and near zero in the longer term.

h. Heavy Duty Vehicles and Engines

Previously adopted emissions standards for new heavy duty engines in the US are summarized below.

Highway Heavy-Duty Emission Standards

YEAR	HC (g/bhp-hr)	CO (g/bhp-hr)	HC + NOX (g/bhp-hr)	NOX (g/bhp-hr)	DIESEL PARTICULATE (g/bhp-hr)
Diesel:					
1991-93	1.3	15.5		5.0	0.25
1994-97	1.3	15.5		5.0	0.10
1998	1.3	15.5		4.0	0.10
2004	1.3	15.5	2.4**		
Urban Buses:					
1991-92	1.3	15.5		5.0	0.25
1993	1.3	15.5		5.0	0.10
1994-95	1.3	15.5		5.0	0.07
1996-97	1.3	15.5		5.0	0.05*
1998	1.3	15.5		4.0	0.05*

Highway Heavy-Duty Emission Standards

Otto-cycle	HC (g/bhp-hr)	CO (g/bhp-hr)		NOX (g/bhp-hr)	EVAPORATIVE HC (g/test)
1991-97					
(A)	1.1	14.4		5.0	3.0
(B)	1.9	37.1		5.0	4.0
1998					
(A)	1.1	14.4		4.0	3.0
(B)	1.9	37.1		4.0	4.0

Note: "(A)" denotes the standard for engines in trucks # 14,000 lbs. Gross Vehicle Weight Rating (GVWR).
"(B)" denotes the standard for engines in trucks $ 14,000 lbs. GVWR.
*.07 g/bhp-hr in-use.
** optional standards of 2.5 are permitted with a NMHC Cap of 0.5

However, with the onset of electronic control systems on heavy duty diesel trucks, it has been more possible to program them to perform differently in use than they do when driving the US EPA heavy duty test cycle. Increased fuel economy under highway driving conditions is possible if injection timing is modified; unfortunately, NOX emissions can increase substantially. After an extensive investigation, the US Justice Department and the Environmental Protection Agency determined that, in fact, this “cheating” has been occurring and recently ordered seven manufacturers of heavy duty diesel engines to spend more than one billion dollars to settle charges that they illegally poured millions of tons of pollution into the air. The seven companies involved comprise 95 percent of the U.S. heavy duty diesel engine market. This is the largest environmental enforcement action in US history.

Due to the settlement, the 2004 NOx standards noted above will be introduced 15 months earlier.

The affected engines emitted more than 1.3 million tons of excess NOX in 1998 alone, which is six percent of NOX emissions from all sources in that year. This is equivalent to the NOX emissions from an additional 65 million cars being on the road.

EPA estimates that the companies will spend collectively more than $850 million to introduce cleaner new engines, rebuild older engines to cleaner levels, recall pickup trucks that have defeat devices installed and conduct new emissions testing. The companies also will ensure that when older heavy duty diesel engines are rebuilt, their excess emissions will be reduced. The companies also will move up the date for meeting certain NOX emission standards applicable to non-road engines such as construction equipment.

Part of the civil penalties will be paid to the California Air Resources Board, with which the companies have made a related settlement.

Beyond the consent agreements, as noted in the original rule regarding the 2004 NOX standard for heavy duty engines, EPA is intending to carry out a careful review in 1999. They will likely propose tightening the gasoline truck standard and requiring OBD on all vehicles and engines. Further, there have been indications that EPA is inclined to tighten the PM standard in 2005 and the NOX standard again in 2007.

A driving force for the tighter PM standard is the urban air toxics initiative which is due in September 1999. Preliminary work to date indicates that diesels are a dominant source.

i. US Truck Definitions

<table>
<tr><th></th><th>GVWR</th><th>Curb Wt.</th><th>Loaded Vehicle Wt.</th><th>Frontal Area</th></tr>
<tr><td>LLDT</td><td>0-6000</td><td></td><td></td><td></td></tr>
<tr><td>LDT</td><td rowspan="3">0-8500</td><td rowspan="3">>6000</td><td></td><td rowspan="6"><45</td></tr>
<tr><td>LDT1</td><td>0-3750</td></tr>
<tr><td>LDT2</td><td>3750<</td></tr>
<tr><td>HLDT</td><td>6001-8500</td><td></td><td></td></tr>
<tr><td>LDT3</td><td>6001-8500</td><td></td><td>0-5750</td></tr>
<tr><td>LDT4</td><td>“</td><td></td><td>5750></td></tr>
<tr><td>HDV</td><td>8500></td><td>6000></td><td></td><td>45></td></tr>
</table>

2. California

a. Light and Medium Duty Vehicles

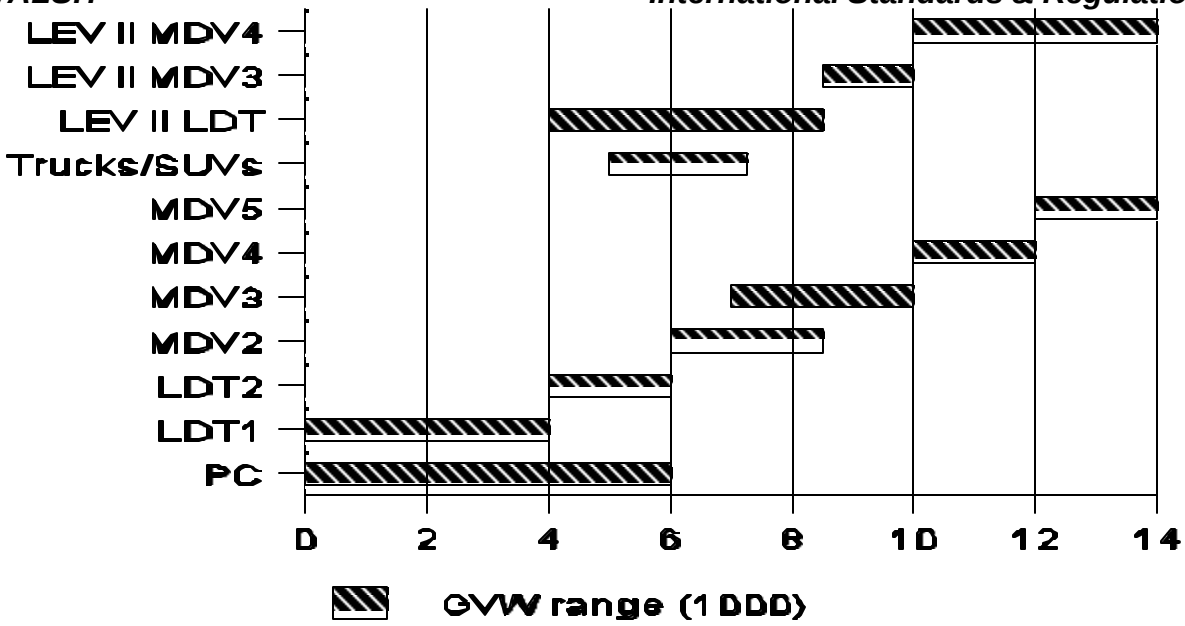
i. Vehicle Classes and Exhaust Emission Standards. There are currently seven vehicle classifications that fall under the LEV program:

passenger cars (PCs) (all weights);
light-duty trucks 0-3750 lbs. loaded vehicle weight (LVW)[7] (LDT1) and
3751-5750 lbs. LVW (LDT2);
medium-duty vehicles 3751- 5750 lbs. test weight (TW) (MDV2),
5751-8500 lbs. TW (MDV3),
8501-10,000 lbs. TW (MDV4), and
10,001-14,000 lbs. TW (MDV5).

The weight classifications for trucks were created in recognition of the larger load carrying capacity and more rigorous duty cycle of trucks that could lead to more severe emission deterioration. Testing of light-duty trucks and medium-duty vehicles also accounts for these differences in load carrying capacities. While LDTs are tested with an extra 300 pounds added to the weight of the vehicle, the weight at which a MDV is tested is higher because it is based on one-half of the payload of the vehicle (generally 1,000 lbs. or more) plus the curb weight. Because the payload of an MDV can vary even within the same model (e.g., a Ford F150 can have a payload ranging from 1390 to 2435 lbs.), the same vehicle platform can be certified as an LDT2 or MDV2. This split in vehicle categories can also happen between MDV2 and MDV3.

Figure 1 illustrates the overlap in these vehicle categories under the current LEV I program. This figure also includes the proposed LEV II vehicle classes that will be discussed later in this report.

7/ There are several classifications for vehicles based on weight. Curb weight is defined as the actual weight of the vehicle. Loaded vehicle weight (LVW) is defined as the curb weight of the vehicle plus 300 pounds. Gross vehicle weight rating (GVW) is the curb weight of the vehicle including the full payload. Test weight (TW), also known as adjusted loaded vehicle weight (ALVW), is the weight at which a medium-duty vehicle is tested and is defined as the average of a vehicle's curb weight and gross vehicle weight.



Within each vehicle classification there are also several emission standards to which a vehicle may certify. In order of increasing stringency, these standards are: transitional low-emission vehicle (TLEV), low-emission vehicle (LEV), ultra-low-emission vehicle (ULEV) and super-ultra-low-emission vehicle (SULEV) and are set forth in Table II-1.

Table II-1

Current Exhaust Mass Emission Standards for TLEV, LEV, and ULEV Passenger Cars and Light-Duty Trucks and LEV, ULEV and SULEV Medium-Duty Vehicles

Vehicle Type	Mileage for Compliance	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate (g/mi)
All PCs; LDT1s (0-3750 lbs. LVW)	50000	Tier 1	0.25	3.4	0.4	n/a	0.08
		TLEV	0.125	3.4	0.4	15	n/a
		LEV	0.075	3.4	0.2	15	n/a
		ULEV	0.04	1.7	0.2	8	n/a
LDT2s (3751-5750 lbs. LVW)	50000	Tier 1	0.32	4.4	0.7	n/a	0.08
		TLEV	0.16	4.4	0.7	18	n/a
		LEV	0.1	4.4	0.4	18	n/a
		ULEV	0.05	2.2	0.4	9	n/a

Vehicle Type	Mileage for Compliance	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate (g/mi)
MDV2s (3751-5750 lbs. TW)	50000	Tier 1	0.32	4.4	0.7	18	n/a
		LEV	0.16	4.4	0.4	18	n/a
		ULEV	0.1	4.4	0.4	9	n/a
		SULEV	0.05	2.2	0.2	9	n/a
MDV3s (5751-8500 lbs. TW)	50000	Tier 1	0.39	5	1.1	22	n/a
		LEV	0.195	5	0.6	22	n/a
		ULEV	0.117	5	0.6	11	n/a
		SULEV	0.059	2.5	0.3	6	n/a
MDV4s 8501 -10,000 lbs. TW	50000	Tier 1	0.46	5.5	1.3	28	n/a
		LEV	0.23	5.5	0.7	28	n/a
		ULEV	0.138	5.5	0.7	14	n/a
		SULEV	0.069	2.8	0.35	7	n/a
MDV5s 10,001-14,000 lbs. TW	50000	Tier 1	0.6	7	2	36	n/a
		LEV	0.3	7	1	36	n/a
		ULEV	0.18	7	1	18	n/a
		SULEV	0.09	3.5	0.5	9	n/a

There are additional emission standards at 100,000 miles for passenger cars and light-duty trucks and 120,000 miles for medium-duty vehicles.

Exhaust Mass Emission Standards for New
2001 - 2003 Model Year Tier 1 Vehicles and 2001 - 2006 Model Year TLEVs, LEVs, and ULEVs
in the Passenger Car and Light-Duty Truck Vehicle Classes;
2001-2002 Model Year Tier 1 Medium-Duty Vehicles; and
2001-2006 Model Year LEV, ULEV and SULEV Medium-Duty Vehicles

Vehicle Type	Durability Vehicle Basis(mi.)	Vehicle Emission Category	NMOG* (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate* (g/mi)
All PCs; LDTs (0-3750 lbs. LVW)	50000	Tier 1	0.25	3.4	0.4	n/a	0.08
		TLEV	0.125	3.4	0.4	15	n/a

Vehicle Type	Durability Vehicle Basis(mi.)	Vehicle Emission Category	NMOG* (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate* (g/mi)
		LEV	0.075	3.4	0.2	15	n/a
		ULEV	0.04	1.7	0.2	8	n/a
	100000	Tier 1	0.31	4.2	0.6	n/a	n/a
		TLEV	0.156	4.2	0.6	18	0.08
		LEV	0.09	4.2	0.3	18	0.08
		ULEV	0.055	2.1	0.3	11	0.04

Vehicle Type	Durability Vehicle Basis(mi.)	Vehicle Emission Category	NMOG* (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate* (g/mi)
LDTs (3751-5750 lbs. LVW)	50000	Tier 1	0.32	4.4	0.7	n/a	0.08
		TLEV	0.16	4.4	0.7	18	n/a
		LEV	0.1	4.4	0.4	18	n/a
		ULEV	0.05	2.2	0.4	9	n/a
	100000	Tier 1	0.4	5.5	0.97	n/a	n/a
		TLEV	0.2	5.5	0.9	23	0.1
		LEV	0.13	5.5	0.5	23	0.1
		ULEV	0.07	2.8	0.5	13	0.05
MDVs (3751-5750 lbs. ALVW)	50000	Tier 1	0.32	4.4	0.7	18	n/a
		LEV	0.16	4.4	0.4	18	n/a
		ULEV	0.1	4.4	0.4	9	n/a
		SULEV	0.05	2.2	0.2	9	n/a
	120000	Tier 1	0.46	6.4	0.98	n/a	0.1
		LEV	0.23	6.4	0.6	27	0.1
		ULEV	0.143	6.4	0.6	13	0.05
		SULEV	0.072	3.2	0.3	13	0.05
MDVs (5751-8500 lbs. ALVW)	50000	Tier 1	0.39	5	1.1	22	n/a
		LEV	0.195	5	0.6	22	n/a
		ULEV	0.117	5	0.6	11	n/a
		SULEV	0.059	2.5	0.3	6	n/a
	120000	Tier 1	0.56	7.3	1.53	n/a	0.12
		LEV	0.28	7.3	0.9	32	0.12
		ULEV	0.167	7.3	0.9	16	0.06
		SULEV	0.084	3.7	0.45	8	0.06

Vehicle Type	Durability Vehicle Basis(mi.)	Vehicle Emission Category	NMOG* (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate* (g/mi)
MDVs 8501 -10,000 lbs. ALVW	50000	Tier 1	0.46	5.5	1.3	28	n/a
		LEV	0.23	5.5	0.7	28	n/a
		ULEV	0.138	5.5	0.7	14	n/a
		SULEV	0.069	2.8	0.35	7	n/a
	120000	Tier 1	0.66	8.1	1.81	n/a	0.12
		LEV	0.33	8.1	1	40	0.12
		ULEV	0.197	8.1	1	21	0.06
		SULEV	0.1	4.1	0.5	10	0.06
MDVs 10,001-14,000 lbs. ALVW	50000	Tier 1	0.6	7	2	36	n/a
		LEV	0.3	7	1	36	n/a
		ULEV	0.18	7	1	18	n/a
		SULEV	0.09	3.5	0.5	9	n/a
	120000	Tier 1	0.86	10.3	2.77	n/a	n/a
		LEV	0.43	10.3	1.5	52	0.12
		ULEV	0.197	10.3	1.5	26	0.06
		SULEV	0.13	5.2	0.7	13	0.06

* For Tier 1 vehicles, NMOG shall mean NMHC as set forth in Section I.D.1.1 of these test procedures.

** Particulate standards are determined on a 50,000 mile basis for Tier 1 passenger cars and light-duty trucks, on a 100,000 mile basis for passenger cars and light-duty trucks and on a 120,000 mile basis for medium-duty vehicles.

2. Phase-In Requirements. One of the flexibilities of the LEV Program is that a manufacturer may chose the standards to which each vehicle is certified provided the overall fleet meets the specified phase-in requirements. For passenger cars and light-duty trucks, the non-methane organic gas (NMOG) emissions averaged over a manufacturer's entire light-duty product line must meet the following values:

Table II-2
Fleet Average NMOG Requirements

Vehicle Category	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
PCs; LDTs 0-3750	0.25	0.231	0.23	0.2	0.157	0.113	0.07	0.1	0.1	0.06
LDTs 3751-5750	0.32	0.295	0.29	0.26	0.205	0.15	0.1	0.1	0.1	0.09

The only instance where a specified percentage is required is for zero-emission vehicles, where each large and intermediate volume manufacturer must produce 10% of its PC and LDT1 production volume as zero-emission vehicles beginning in 2003. The separate fleet average values for the heavier category of light-duty trucks reflects the higher emission standards applicable to these trucks and the lack of a separate ZEV requirement pertaining to these vehicles.

There are two types of medium-duty vehicles - those that are certified using the chassis dynamometer (the left column of Table II-3) and those certified using an engine dynamometer (the right column of Table II-3). Medium-duty vehicles have separate requirements based on a percent phase-in schedule because the numerous vehicle weight classifications make a fleet average requirement difficult to implement.

Table II-3
Medium-Duty Vehicle Phase-In Requirements

Model Year	Chassis Certified Vehicles (% Sales)			Engine Certified Vehicles (% Sales)		
	Tier 1	LEV	ULEV	Tier 1	LEV	ULEV
1998	73	25	2	100	0	0
1999	48	50	2	100	0	0
2000	23	75	2	100	0	0
2001	0	80	20	100	0	0
2002	0	70	30	0	100	0
2003	0	60	40	0	100	0
2004 +	0	60	40	0	0	100

50,000 Mile Certification Standards (g/mi) for Passenger Cars Operating on Gasoline

	NMOG*	CO	NOx
1993 MY	**0.25**	**3.4**	**0.4**
TLEV	**0.125**	**3.4**	**0.4**
LEV	**0.075**	**3.4**	**0.2**
ULEV	**0.04**	**1.7**	**0.2**

* NMOG is substituted for conventional hydrocarbons because the constituents in the exhaust could change as fuels change in the future; these emissions will be reactivity adjusted for cleaner burning fuels.

Implementation Rates for Conventional Vehicles, TLEVs, LEVs, ULEVs, and ZEVs Used to Calculate Fleet Average Standards for Passenger Cars.

MODEL YEAR	0.39	0.25	0.125	TLEV 0.075	LEV 0.040	ULEV 0.00	ZEV*	FLEET AVERAGE STANDARD
1994		10%	80%	10%				0.250
1995			85	15				0.231
1996			80	20				0.225
1997			73		25%	2%		0.202
1998			48		48	2	2%	0.157
1999			23		73	2	2	0.113
2000					96	2	2	0.073
2001					90	5	5	0.070
2002					85	10	5	0.068
2003					75	15	10	0.062

* The percentage requirements for ZEVs are mandatory starting in 2003.

b. Medium Duty Vehicles

Phase-In of Medium Duty Vehicle Emission Standards

Model Year	Chassis-Certified Phase-In (%)			Engine-Certified Phase-In (%)		
	Tier I	LEV	ULEV	Tier I	LEV	ULEV
1998	73	25	2	100	0	0
1999	48	50	2	100	0	0

	Tier I	LEV	ULEV	Tier I	LEV	ULEV
2000	23	75	2	100	0	0
2001	0	80	20	100	0	0
2002	0	70	30	0	100	0
2003	0	60	40	0	100	0
2004 +	0	60	40	0	0	100

Exhaust Emission Standards for Medium-duty Chassis-Certified Vehicles
(g/mi)

Test Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG	CO	NO_X	PM
3751-5750	50,000	LEV	0.160 (.238)	4.4	0.4 (0.6)	n/a
		ULEV	0.100 (.128)	4.4	0.4 (0.6)	n/a
		SLEV	0.050	2.2	0.2	n/a
	120,000	LEV	0.230	6.4	0.6 (0.8)	0.10
		ULEV	0.143 (.160)	6.4	0.6 (0.8)	0.05
		SLEV	0.072	3.2	0.3	0.05
5751-8500	50,000	LEV	0.195 (.293)	5.0	0.6 (0.9)	n/a
		ULEV	0.117 (.156)	5.0	0.6 (0.9)	n/a
		SLEV	0.059	2.5	0.3	n/a
	120,000	LEV	0.280	7.3	0.9 (1.2)	0.12
		ULEV	0.167 (.195)	7.3	0.9 (1.2)	0.06
		SLEV	0.084	3.7	0.45	0.06
8501-10000	50,000	LEV	0.230 (.345)	5.5	0.7 (1.0)	n/a
		ULEV	0.138 (.184)	5.5	0.7 (1.0)	n/a
		SLEV	0.069	2.8	0.35	n/a
	120,000	LEV	0.330	8.1	1.0 (1.3)	0.12
		ULEV	0.197 (.230)	8.1	1.0 (1.3)	0.06
		SLEV	0.100	4.1	0.5	0.06
10001-14000	50,000	LEV	0.300 (.450)	7.0	1.0 (1.5)	n/a
		ULEV	0.180 (.240)	7.0	1.0 (1.5)	n/a
		SLEV	0.090	3.5	0.5	n/a
	120,000	LEV	0.430	10.3	1.5 (2.0)	0.12
		ULEV	0.257 (.300)	10.3	1.5 (2.0)	0.06
		SLEV	0.130	5.2	0.7	0.06

Medium-Duty Engine-Certified Emission Standards
(g/bhp-hr)

Model Year	Vehicle Emissions Category	Carbon Monoxide	Non-Methane Hydrocarbons and Oxides of Nitrogen	Formaldehyde	Particulate
1992-2001	LEV	14.4	3.5	0.050	0.10
2002-2003	LEV	14.4	3.0	0.050	0.10
1992-2003	ULEV	14.4	2.5	0.025	0.10
1996 and subsequent	SLEV	7.2	2.0	0.025	0.05
2004 and subsequent	ULEV	14.4	NMHC 0.5 NO_X 2.0	0.050	0.10

c. New "LEV2" Standards

On November 5th, CARB adopted a plan to require passenger cars and certain sport utility vehicles (SUVs), minivans and large pickup trucks to meet tighter emission standards beginning in 2004.

These amendments include the following primary elements:

< Restructuring vehicle weight classifications so that all current light-duty trucks, and all current medium-duty vehicles having a gross vehicle weight (GVW) of less than 8,500 lbs., would generally be subject to the same LEV and ULEV standards as passenger cars; only the very heaviest SUVs and pick-up trucks would remain subject to separate medium-duty vehicle standards;

< New more stringent "LEV II" exhaust emission standards for the current LEV, ULEV and SULEV categories, which would be phased in from the 2004 to 2007 model years; the changes include reducing the NOx standard for passenger cars and light-duty trucks certified to the LEV and ULEV standards to 0.05 g/mi from the current 0.2 g/mi level, equivalent NOx reductions for medium-duty vehicles, more stringent particulate emission standards for diesel vehicles, increasing the useful life for passenger cars and light-duty trucks from the current 100,000 miles to 120,000 miles, a new light-duty SULEV category would be created with an NMOG standard less than one-fourth of the level for ULEVs, and a manufacturer option of certifying any LEV, ULEV or SULEV to a 150,000 mile certification standard, resulting in greater NMOG credits as long as the manufacturer provides an 8-year/100,000-mile warranty for high-cost parts rather than for the normal 7-years/70,000 miles;

< Continuing yearly reductions in the fleet average NMOG requirements from model years 2004 through 2010, when the fleet average NMOG requirement for passenger cars would be 0.035 g/mi; there would be a separate phase-in schedule for the heavier light-duty trucks in the new LDT2 class, and for medium-duty vehicles the requirement of a 60/40 mix of

LEVs and ULEVs in 2004 and subsequent model years would be changed to 40/60;

< A new "partial ZEV allowance" mechanism under which advanced technology vehicles could provide partial credits towards satisfying a manufacturer's ZEV requirement; in order to receive any ZEV allowance, a vehicle would have to qualify for the "baseline ZEV allowance" of 0.2 by meeting the SULEV standard at 150,000 miles, satisfying applicable second generation on-board diagnostics requirements (OBD II), having "zero" evaporative emissions, and carrying an emission warranty covering all malfunctions identified by the OBD II system for 15 years or 150,000 miles; an additional allowance would be provided based on the potential for realizing zero-emission VMT (e.g., capable of some all-electric operation traceable to energy from off-vehicle charging), up to a maximum of 0.6; and a vehicle that uses fuel with very low fuel-cycle emissions could receive a ZEV allowance of up to 0.2; a large volume manufacturer would have to meet at least 40% of its ZEV requirement with true ZEVs or vehicles with a 1.0 ZEV allowance;

< More stringent evaporative emission standards for the 3-day diurnal-plus-hot-soak test and the 2-day diurnal-plus-hot-soak test, applicable to both fuel and non-fuel vehicle emissions and for a useful-life of 15 years or 150,000 miles, whichever first occurs; certification to the new standards would be required for 40% of a manufacturer's vehicles in the 2004 model year, 80% in the 2005 model year, and 100% in the 2006 model year, with an optional alternative phase-in mechanism; and

< "CAP 2000" amendments which would significantly reduce the emission testing and reporting requirements for new vehicle certification, and substitute new requirements that manufacturers conduct more extensive compliance tests of in-use vehicles that have accumulated substantial mileage;

The four basic strategies to achieve the stringent exhaust emission standards are more precise fuel control, improved fuel delivery, better catalytic converter performance, and reduced base engine-out levels;

An element of the approved amendments allows a manufacturer to certify up to 4% of its truck sales in the LDT2 category to a marginally higher NOx emission standard (0.07 for 50,000 miles and 0.10 for 120,000 and 150,000 miles); this will satisfy a manufacturer's need to engineer some of its heavier trucks for more rigorous duty.

The CAP 2000 elements of the approved amendments will allow manufacturers to divert significant resources presently devoted to vehicle certification and redirect them toward in-use compliance in order to provide greater assurance that vehicles are actually complying with the standards in-use; the amendments will also result in cost savings for manufacturers of from $36 million to $57 million per year;

The projected costs to comply with the amendments are expected to range from about $100 to $200 per vehicle, with an-average of about $107; the estimated cost-effectiveness ranges from $0.50 to $1.39 per pound of ROG + NOx reduced (about $1 per pound overall), which compares very favorably to the typical cost-effectiveness values for current air pollution control measures.

i. New Standards

Effective with the 2004 model year, the following standards apply.

Vehicle Type	Mileage for Compliance	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g.mi)	Formaldehyde (mg/mi)	Diesel Particulate (g/mi)
All Pcs; LDTs<8,500 lbs. GVW	50000	LEV	0.075	3.4	0.05	15	n/a
		LEV[1]	0.075	3.4	0.07	15	n/a
		ULEV	0.04	1.7	0.05	8	n/a
	120000	LEV	0.09	4.2	0.07	18	0.01
		LEV[1]	0.09	4.2	0.1	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.01	1	0.02	4	0.01
	150000	LEV	0.09	4.2	0.07	18	0.01
		LEV[1]	0.09	4.2	0.1	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.01	1	0.02	4	0.01
MDVs 8,500-10,000 lbs. GVWR	120000	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.1	3.2	0.1	8	0.06
MDVs 10,001-14,000 lbs. GVWR	120000	LEV	0.23	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06

(1) This optional LEV standard applies to up to 4% of a manufacturers LDT2 fleet with a maximum base payload in excess of 2500 lbs.

After the 2003 model year, Tier 1 standards (0.25 grams per mile NMHC) and TLEV standards would be eliminated as available emissions categories. The 50°F multiplier for SULEVs would be 2.0 and the cold temperature carbon monoxide standard would be 10.0.

ii. Fleet Average Requirements

Prior to the elimination of the TLEV category, CARB staff identified the following possible implementation rate to comply with the NMOG requirement.

Implementation Rates for TLEVs, LEVs, ULEVs, SULEVs, and ZEVs Used to Calculate Fleet Average Standards for Passenger Cars and Light-Duty Trucks 0-3750 lb. LVW

Model Year	TLEV	LEV	ULEV	SULEV	ZEV	Fleet Average Requirement
2004	2	48	35	5	10	0.053
2005	2	40	38	10	10	0.049
2006	2	35	41	12	10	0.046
2007	1	30	44	15	10	0.043
2008	1	25	44	20	10	0.04
2009	1	20	49	20	10	0.038
2010	1	15	49	25	10	0.035

Because trucks in the new LDT2 category are not as far along in meeting the proposed emission standards as PCs, and because there is no zero-emission vehicle (ZEV) requirement for LDTs 3751-5750 lb. LVW or medium-duty vehicles 0-8500 lb. TW, the fleet average requirement being proposed would be slightly higher than those for PCS.

Implementation Rates for TLEVs, LEVs, ULEVs, SULEVs, and ZEVs Used to Calculate Fleet Average Standards for Light-Duty Trucks 3751-7300 lb. LVW

Year	TLEV	LEV	ULEV	SULEV	Fleet Average
2004	2	75	21	2	0.067
2005	2	65	31	2	0.064
2006	2	55	38	5	0.059
2007	1	45	49	5	0.055
2008	1	35	54	10	0.05
2009	1	25	64	10	0.047
2010	1	20	64	15	0.043

The new Low-Emission Vehicle (LEV II) regulatory package could be the "death knell" for diesel use in California unless industry is able to produce "breakthrough" technology along that front.

California Truck Definitions

	GVWR	LVW
LDT	0-6000	
LDT1		0-3750
LDT2		3750<
HDV	6000<	
MDV[a]	6001-8500	
MDV[b]	<14,000	

a = any pre 1995 heavy duty vehicle
b = Post '92 LEV, ULEV, SULEV, ZEV

3. Economic Commission For Europe (ECE)

a. Light Duty Vehicles

	CO	HC	NO_x	HC + NO_x
ECE 15 Level	02 03 04	02 03	02 03	04
Type I Test Reference Weight (kg)				
750	80 85 58	6.8 6.0		19.0
751 - 850	87 71 58	7.1 6.3	10.0 8.5	19.0
851 - 1020	94 76 58	7.4 6.5	10.0 8.5	19.0
1021 - 1250	107 87 67	8.0 7.1	10.0 8.5	20.5
1251 - 1470	122 99 76	8.6 7.6	12.0 10.2	22.0
1471 - 1700	135 110 85	9.2 8.1	14.0 11.9	23.5
1701 - 1930	149 121 93	9.7 8.6	14.5 12.3	25.0
1931 - 2150	162 132 101	10.3 9.1	15.0 12.8	26.5
2150	176 143 110	10.5 9.5	15.5 13.2	28.0
			16.0 13.6	
All vehicles [Type II Test]	Maximum concentration of CO at end of last urban cycle; 02 levels - 4.5%; 03 and 04 levels - 3.5%			
All vehicles [Type II Test]	No crankcase emissions permitted			

Notes:

1. Regulation 15 applies to vehicles up to 3.5 t GVW. Only gasoline-fueled vehicles are covered by 0l/02/03 Amendments, but the 04 Amendment also applies to diesel-powered vehicles.
2. The constant volume sampling measurement technique was introduced with the 04 Amendment. Fuel consumption and power measurement procedures are detailed in the Regulations, but do not include any limits.
3. The O3 Amendment came into force on 1st October 1979 and the 04 Amendment on 1.10 84 for new models, 1.10.86 for existing models. Mandated introduction dates in individual countries vary and may be later than these dates.
4. The limits quoted are those for type approval. Production vehicles are permitted to exceed these figures by up to 30% for HC, and up to 20% for CO and NO_x. The limit for HC + NO_x in the 04 Amendment is 25%.

5. ECE R 15-04 = ECE R 83 (A)[8] = 83/351/EEC

Passenger cars and light-duty trucks
70/220/EEC corresponds to ECE-R15/00
83/351/EEC corresponds to ECE-R15/04 and ECE-R83/00
91/441/EEC corresponds to ECE-R83/01 (Approval B) Lead free petrol is required
93/59/EEC corresponds to ECE-R83/02
94/12/EEC corresponds to ECE-R83/03
96/69/EEC no corresponding ECE-regulation
"Proposal 2000, Phase 3" no corresponding ECE-regulation
"Proposal 2005, Phase 4" no corresponding ECE-regulation

Diesel fuelled heavy-duty engines
88/77/EEC corresponds to ECE-R49/01
91/542/EEC corresponds to ECE-R49/02 (Both "level A" and "level B")
"Proposal EURO 3" no corresponding ECE-regulation
"Proposal EURO 4" no corresponding ECE-regulation

Motorcycles
ECE-R40 no corresponding EEC-regulation
ECE-R40/01 no corresponding EEC-regulation
"EU 97 Proposal" no corresponding ECE-regulation

Mopeds
ECE-R47 no corresponding EEC-regulation
"EU 97 Proposal" no corresponding ECE-regulation
"EU 99 Proposal" no corresponding ECE-regulation

ECE R 83/01 B & C[9] = 91/441/EEC
ECE R 83/02 B & C = 93/59/EEC
ECE R 83/03 B & C = 94/12/EC

8/A applies to leaded gasoline fueled vehicles only

9/B applies to unleaded gasoline fueled vehicles only; C applies to diesel fueled vehicles only.

Type Approval Standards For Light Duty Vehicles

Pollutant	**91/441/EEC**	**94/12 EC**		
		Gasoline	Diesel	DI Diesel
CO (g/km)	2.72	2.2	1	1
HC + NOx (g/km)	0.97***	0.5	0.7	0.9
PM (g/km)*	0.14***		0.08	0.1
Evap. HC**	2.0 g/test	2.0 g/test		

* Diesel Only
** Gasoline Only
*** For DI Diesels, standards increased by factor of 1.4 until 7/1/94

Type Approval Standards For Heavy Duty Engines (g/kWh) ECE 24.03 and EU Directive 72/306/EEC

	CO	**HC**	**NOX**
ECE 49	14	3.5	18
ECE 49.01	11.2	2.4	14.4

Smoke Limits

Smoke Limits Under Steady State Conditions	
Nominal Flow (liters/second)	Absorption Coefficient (m^{-1})
42100200	2.26 1.495 1.065
Intermediate Values Are Also Specified	
Opacity under free acceleration should not exceed the approved level by more than 0.5 m^{-1}	

b. ECE Regulation 40/40.01 for Exhaust Emission Limits for Motorcycles with 4-stroke Engines.

	CO (g/km)	
Reference Weight R(1) (kg)	ECE 40 (2)	ECE 40.01(2)
<100	25 {30)	17.5 {21}
100-300	(25+25$^{(R-100)}$)/200	(17.5+17.5$^{(R-100)}$)/200
{100-300}	(30+30$^{(R-100)}$)/200	(21+21$^{(R-100)}$)/200
>300	50 (60)	35 (42)
	HC(g/km)	
Reference Weight R(1) (kg)	ECE 40 (2)	ECE 40.01(2)
< 100	7{10}	4.2(6)
100-300	(7 + 3$^{(R-100)}$)/200	(4.2 + 1.8$^{(R-100)}$)/200
{100-300}	{10 + 4$^{(R-100)}$)/200	(6 + 2.4$^{(R-100)}$)/200
>300	10 {14}	6 (8.4)

Notes: 1) Reference weight (R) - Motorcycle weight + 75 kg.
2) Limits are for type approval. Limits given in parenthesis () apply to conformity of production.

c. ECE Regulation 40/40.01 for Exhaust Emission Limits for Motorcycles with 2-stroke Engines.

	CO(g/km)	
Reference Weight R (1) (kg)	ECE 40 (2)	ECE40.01(2)

	CO(g/km)	
<100 100 - 300 {100 - 300} >300	16 (20) $(16 + 24^{(R-100)})/200$ $(20 + 30^{(R-100)})/200$ 40 (50)	12.8 $(12.8 + 19.2^{(R-100)})/200$ $(16 + 24^{(R-100)})/200$ 32 (40)
	HC (g/km)	
Reference Weight R[(1)] (kg)	ECE 40 [(2)]	ECE 40.01[(2)]
< 100 100 - 300 {100 - 300_ >300	10 (13) $(10 + 5^{(R-100)})/200$ $(13 + 8^{R-100)})/200$ 15(21)	8 (10.4) $(8 + 4^{(R-100)})/200$ $(10.4 + 6.4^{(R-100)})/200$ 12 (16.8)

Notes: 1) Reference weight (R) = Motorcycle weight + 75 kg.

2) Limits are for type approval. Limits given in parenthesis ( ) apply to conformity of production.

d. ECE Regulation 47 for Exhaust Emission Limits for Mopeds

Vehicle type	**2-Wheeled**		**3-Wheeled**	
Pollutant	CO g/km	HC g/km	CO g/km	HC g/km
Licensing	8.0	5.0	15.0	10.0
Production	9.6	6.5	18.0	13.0

The following European countries currently apply ECE 40.01 and ECE R47:

Belgium, Finland, France, Germany, Italy, Luxembourg, The Netherlands , UK, Hungary, Norway,

Romania, Russian Federation (CIS), Czech Republic, Slovak Republic.

4. European Union

a. Linkage Between EU and ECE Regulations

EU Directive	Equivalent ECE Regulation	Vehicle Type & Emission Control
70/220/EEC	ECE R15	Exhaust Emissions For Gasoline Passenger Cars & Light Trucks
74/290/EEC	ECE R 15.01	"
77/102/EEC	ECE R 15.02	"
78/665/EEC	ECE R 15.03	"
83/351/EEC	ECE R 15.04	"Exhaust Emissions For Gasoline & Diesel Passenger Cars & Light Trucks
91/441/EEC	ECE R 83.01	Passenger Cars: revised exhaust emissions plus evaporative emissions by ECE R15+ EUDC cycles (R83 Type Approvals B and C for unleaded gasoline and diesel respectively)
72/306/EEC	ECE R 24.03	Heavy Duty diesel black smoke emissions
87/77/EEC	ECE R 49.01	Heavy Duty diesel exhaust emissions
88/77/EEC	"	"
88/436/EEC		Revised PM standards for passenger cars
91/542/EEC		EU Clean Lorry Directive for heavy duty diesel exhaust emissions
93/59/EEC		Exhaust emissions for light commercial vehicles (M1 & N1)
94/12/EC		Revised exhaust emission standards for passenger cars
96/69/EC		Amends 70/220 & 93/59 exhaust emissions for passenger cars and LCV
	ECE R 40	Motorcycle Exhaust emissions
	ECE R 47	Moped Exhaust Emissions

After extensive debate during 1996 and 1997, the European Parliament and the Council of Ministers

reached agreement on June 30 regarding the Euro 3 and Euro 4 requirements for passenger cars and light commercial vehicles. Major elements of the agreement are summarized below.

b. Passenger Cars

The limit values in grams per kilometer - (g/km) set out in the table represent the final Conciliation values agreed on June 30 (present limit values are indicated in brackets):

TYPE OF POLLUTANT					
	Carbon monoxide (CO)	Mass of hydrocarbons (HC)	Mass of oxides of nitrogen (NOX)	Combined mass of hydrocarbons and oxides of nitrogen (HC + NOX)	Mass of particulate (PM)
2000	P: 2,3 (2,2) D: 0,64 (1,0)	P: 0,20 D: -	P: 0,15 D: 0,50	P: - (0,5) D: 0,56 (0,7)	P: - D: 0,05 (0,08)
2005 (*)	P: 1,00 D: 0,50	P: 0,10 D: -	P: 0,08 D: 0,25	P: - D: 0,30	P: - D: 0,025

P = PetrolD = Diesel

c. Light Duty Trucks

Current Requirements

Class Of Vehicle	Fuel	CO	HC+NOX	PM*	Date of Application
Class 1 (<1250 Kg)	All**	2.72	0.97	0.14	10/1/93 10/1/94
"	Gasoline***	2.2	0.5	-	10/1/97
"	Diesel IDI***	1	0.7	0.08	10/1/97
"	Diesel DI***	1	0.9	0.1	10/1/97
"	Diesel DI***	1	0.7	0.08	10/1/99
Class 2 (1251< >1700)	All**	5.17	1.4	0.19	10/1/93 10/1/94
"	Gasoline***	4	0.6	-	10/1/98

Class Of Vehicle	Fuel	CO	HC+NOX	PM*	Date of Application
"	Diesel IDI***	1.25	1	0.12	10/1/98
"	Diesel DI***	1.25	1.3	0.14	10/1/98
"	Diesel DI***	1.25	1.1	0.14	10/1/99
Class 3 (<1700 Kg)	All**	6.9	1.7	0.25	10/1/93 10/1/94
"	Gasoline***	5	0.7	-	10/1/98
"	Diesel IDI***	1.5	1.2	0.17	10/1/98
"	Diesel DI***	1.5	1.6	0.2	10/1/98
"	Diesel DI***	1.5	1.3	0.2	10/1/99

* Diesel Vehicles Only
** 93/59/EEC
*** 96/69/EC

New Gasoline Light Truck Standards

Reference Mass (RW) kg	CO g/km		HC g/km		NOx g/km	
Class	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**
I RW <1305	**2.3**	**1**	**0.2**	**0.1**	**0.15**	**0.08**
II 1305 < RW <1760	**4.17**	**1.81**	**0.25**	**0.13**	**0.18**	**0.1**
III 1760 <RW	**5.22**	**2.27**	**0.29**	**0.16**	**0.21**	**0.11**

New Diesel Light Truck Standards

Reference Mass (RW) kg	CO g/km		HC + NOx g/km		NOx g/km		PM g/km	
Class	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**

Reference Mass (RW) kg	CO g/km		HC + NOx g/km		NOx g/km		PM g/km	
I RW <1305	0.64	0.5	0.56	0.3	0.5	0.25	0.05	0.03
II 1305 < RW <1760	0.8	0.63	0.72	0.39	0.65	0.33	0.07	0.04
III 1760 <RW	0.95	0.74	0.86	0.46	0.78	0.39	0.1	0.06

Steps 3 and 4, for passenger cars and light commercial vehicles (Class 1) will go into effect in 2000 and 2005, respectively. Steps 3 and 4 for other light commercial vehicles (Class 2 and Class 3) will go into effect in 2001 and 2006, respectively.

Several other requirements were also agreed to:

- OBD systems will be required for gasoline vehicles from 2000 and diesel vehicles from 2003; Class 2 and 3 light commercial vehicles will be delayed until 2005.
- Gasoline fueled passenger cars and light commercial vehicles must comply with a low temperature test (7 degrees C) from 2002.
- Fiscal measures can be used to promote the early introduction of 2005 compliant technologies.
- The Commission must come forward by the end of 1999 with a proposal confirming or complementing the Directive but in particular addressing low temperature tests for heavier light commercial vehicles and threshold limit values for OBD for 2005, among other items, and
- The Commission must come forward with additional proposals beyond 1999 addressing longer term Community air quality objectives.

d. Fuels

Petrol	Unit	Average Today	Proposed Average	Maximum from 2000	Maximum from 2005
RVP Summer	kPa	68	58	60	-
Aromatics	% (v/v)	40	37	42	35
Benzene	% (v/v)	2.3	1.6	1	-

Petrol	Unit	Average Today	Proposed Average	Maximum from 2000	Maximum from 2005
Sulphur	ppm	300	150	150	50
Olefins	% (v/v)			18	-
Oxygen	% (m/m)			2.7	-
Diesel	Unit				
Polyaromatics	% (v/v)	9	6	11	
Sulphur	ppm	450	300	350	50
Cetane Number				51 (Min)	-
Density 15 °	Kg/m3			845	-
Distillation 95%	°C			360	-

< Derogation for a Member State from the sulphur limits because of severe socio-economic problems may be authorized by the Commission for no more than three years starting from 2000 or for two years from 2005.

< The Commission will be required to make a proposal **no later the end of 1999** with proposals to complement the above specifications.

< The marketing of leaded gasoline is prohibited in the Community from 1 January 2000; however, a Member State could request a derogation until 2005 if it demonstrates that the introduction of a ban would result in severe socio-economic problems or would not lead to overall environmental or health benefits because, inter alia, of the climatic situation in that Member State. The lead content of leaded gasoline could not exceed 0.15 gr/l.

< Leaded gasoline to be used by old vehicles and distributed through special interest groups would not be affected by the ban (but sales could not exceed 0,5% of total gasoline sales).

< In order to protect human health and/or the environment in specific agglomerations or ecologically sensitive areas with special problems of air quality, Member States would be permitted - subject to a derogation requested in advance and backed up by evidence - to require that fuels sold in these areas comply with more stringent environmental specifications than those established under the Directive.

e. Heavy Duty Vehicles

Following the decisions on light duty vehicles, the Commission followed up almost immediately with a proposal for tightening heavy duty vehicle standards as summarized below.

Technology	Test	CO g/kWh	HC g/kWh	NOX g/kWh	PM g/kWh
ECE R 49	13-Mode	14.0	3.5	18.0	-
ECE R 49.01 (88/77/EEC)	13-Mode	11.2 (13.2)	2.4 (2.6)	14.4 (15.8)	-
Euro 1[10]	13-Mode	4.5 (4.9)	1.1 (1.23)	8.0 (9.0)	0.63 (<85Kw)(.40) 0.36 (>85Kw)(.68)
Euro 2	13-Mode	4.0	1.1	7.0	0.15 (<85Kw) 0.25 (>85Kw)
Proposed[11] Euro 3 Conventional Diesel	ESC & ELR (OICA)	2.1	0.66	5.0	0.10 0.13[12]
Proposed Euro 3 Advanced Diesel	ETC (FIGE)	5.45	0.78 (NMHC)	5.0	0.16 0.21[13]
Gas	ETC (FIGE)	5.45	0.78 (NMHC) CH4:1.6	5.0	NA

< The proposed limits are intended to achieve a 30% reduction from Euro II, in accordance with the recommendations resulting from Auto-Oil 1. They will go into effect on 1 October 2000 for new types and 1 October 2001 for registration, sale and entry into service.

< So as to allow time for the potential development of a new worldwide harmonized test cycle and to gain a better understanding of heavy duty engine control technologies, no Euro IV limits were proposed by the Commission. An emissions reduction target of up to 40% compared to Euro III is contemplated, however. It was intended that the Commission would make proposals for Euro IV limits by 31 December 1999 taking into account:
  - < the results of Auto-Oil II;
  - < developments with regard to emission control technology including the interdependence with fuel quality;
  - < the development of the worldwide harmonized test cycle;

10/91/542/EEC and ECE R 49/02

11/By the European Commission

12/For engines having a swept volume of less than 0.7 dm^3 per cylinder and a rated power speed of more than 3000 min^{-1}.

13/Ibid.

- < the development of OBD for heavy duty engines; and
- < the need for specific durability provisions for diesel and gas engines.

On October 13, the European Parliament Environment Committee approved modifications to the Heavy Duty Engines Directive as proposed by the rapporteur, Bernd Lange.

Limit Values for Diesel Engines on ESC and ELR Tests
(Conventional Engines +/- oxidation catalyst

Date of Implementation	CO	HC	NOX	PM	Smoke
	Grams/Kilowatt-Hr (g/kWh)				m^{-1}
2000/01	2.1	0.66	5.0	0.10 0.13 (a)	0.8
2005/06	1.5	0.25	2.0	0.05	0.3

Limit Values for Diesel and Gas Engines on ETC Test
(Diesel Engines with Advanced Aftertreatment including PM Traps and DENOX catalysts

Date of Implementation	CO	NMHC	Methane (b)	NOX	PM (c)
	Grams/Kilowatt-Hr (g/kWh)				
2000/01	5.45	0.78	1.6	5.0	0.16 0.21 (a)
2005/06	4.0	0.25	0.9	2.0	0.08

(a) = For engines having a swept volume of less than 0.7 dm^3 per cylinder and a rated power speed of more than 3000 min^{-1}
(b) = For natural gas engines only
(c) = For diesel engines only

Other significant aspects include:

- From 2005, the useful life is defined as five years or 100,000 km (Group N1), 200,000 km (Group N2) and 500,000 km (Group N3)
- OBD will apply from 2005
- The Commission is instructed to make a proposal by the end of 2001 on OBD, durability, in-service testing and a differentiated type approval dependent on type of use e.g. urban or long distance
- Harmonization of worldwide test cycles encouraged from 2005
- Reference fuel to be 300 PPM max. sulphur for 2000; 50 PPM max. for 2005

Then on October 20th and 21st, the full European Parliament had its first reading. Just beforehand, on the 19th, Heidi Hautala (the former rapporteur for the Fuels Directive) submitted a further amendment tightening the particulate limits on the European transient cycle (ETC) from 0.08 g/kWh as proposed by Lange to 0.03 g/kWh.

After a short debate on the 20th in which most speakers were in favor of the Lange report and amendments, his proposals received broad support on the 21st. The major exception was the

Hautala amendment which was approved with a majority of 303 votes in favor (only 10 short of the absolute majority needed in the 2nd reading) and 235 votes against.

In response to the Parliament, the Council of Ministers amended the Commission proposal during their meeting on December 21st. The limits are expected to require the mandatory fitment of particulate traps in 2005 and DeNOx or SCR catalysts in 2008. The Parliament will be urged to accept these values in a second reading, perhaps as early as the end of February.

In summary the Ministers agreed to the following:

- 2000 (Euro 3) - as the Commission proposed (see tables below) for an overall 30% reduction from current levels but with the derogation for small high speed diesel engines extended from a cylinder swept volume of 0.70 liters to 0.75 liters.
- 2005 (Euro 4) - mandatory CO, HC and NOX limits that can probably be achieved by engine improvements but mandatory particulate limits that reflect the need for particulate traps. All engines are to be tested on **both** cycles except gas engines which are only tested on the ETC cycle. This means a 50% reduction in CO, HC and NOX and an 80% reduction in PM from current limit values.
- The German delegation made a proposal that was eventually supported by all Member States for a further stage in 2008 with a NOX standard of 2.0 g/kWh on both cycles (reflecting the need for DeNOx or SCR catalysts). This is a 70% reduction in NOX from current limit values. At the insistence of the Commission and several other Member States the Commission has to report by the end of 2002 and "consider the available technology with a view to confirming the mandatory NOX standard for 2008 in a report to the Council and the Parliament, accompanied, if necessary, by appropriate proposals."
- The limit values for Enhanced Environmentally Friendly Vehicles (EEV's) are 2.0 g/kWh NOX and 0.02 g/kWh PM on both cycles. These standards should serve as the basis for voluntary purchases of urban vehicles such as buses.

Limit Values for Diesel Engines on ESC and ELR Tests
(Conventional Engines +/- oxidation catalyst

Date of Implementation	CO	HC	NOX	PM	Smoke
	Grams/Kilowatt-Hr (g/kWh)				m^{-1}
2000/01	2.1	0.66	5.0	0.10 0.13 (a)	0.8
2005/06	1.5	0.25	3.5	0.02	0.3
2008/09	1.5	0.25	2.0	0.02	0.3

Limit Values for Diesel and Gas Engines on ETC Test
(Diesel Engines with Advanced Aftertreatment including PM Traps and DENOX catalysts

Date of Implementation	CO	NMHC	Methane (b)	NOX	PM (c)
	Grams/Kilowatt-Hr (g/kWh)				
2000/01	5.45	0.78	1.6	5.0	0.16 0.21
2005/06	4.0	0.25	0.9	3.5	0.03
2008/09	4.0	0.25	0.9	2.0	0.03

(a) = For engines having a swept volume of less than 0.75 dm^3 per cylinder and a rated power speed of more than 3000 min^{-1}
(b) = For natural gas engines only
(c) = For diesel engines only

f. Motorcycles and Mopeds

Directive 97/24 was issued on June 17, 1997.

(g/km)

Motorcycles (Above 50cc)				3-Wheelers, 4- Wheelers		
	CO	HC	NOx	CO	HC	NOx
2 Stroke 17/6/1999	8	4	0.1	12	6	0.15
4 Stroke 17/6/1999	13	3	0.3	19.5	4.5	0.45

(g/km)

	Mopeds		3-Wheelers, 4- Wheelers	
	CO	HC+NOx	CO	HC+NOx
17/6/99	6	3	12	6
17/6/00	1	1.2	3.5	1.2

5. German Tax Incentives For Clean Vehicles

Road tax rates in DM per 100 cm^3

Car Group	Present Rate	Rate from 1.7.97	Rate from 1.1.01	Rate from 1.1.04	Rate from 1.1.05
Euro 3 Euro 4 3 liter car					
-petrol		10.00	10.00	13.20	13.20
-diesel		27.00	27.00	30.20	30.20
Euro 2					
-petrol	13.20	12.00	12.00	14.40	14.40
-diesel	37.10	29.00	29.00	31.40	31.40
Euro 1					
-Petrol	13.20	13.20	21.20	21.20	29.60
-Diesel	37.10	37.10	45.10	45.10	53.50
Other Vehicles used in Ozone alerts					
-Petrol	21.60	21.60	29.60	29.60	41.20
-Diesel	45.50	45.50	53.50	53.50	65.10
Cars not used in Ozone alerts					
-Petrol	13.20	33.20	41.20	41.20	49.60
-Diesel	37.10	57.10	65.10	65.10	73.50
Cars with partially clean or without clean exhausts					
-Petrol*	18.80	41.60	49.60	49.60	49.60
**	21.60				
-Diesel*	42.70	65.50	73.50	73.50	73.50
**	45.50				

.First registered before 1.1.86
**First registered after 1.1.86

< Euro 3 (which so far means to comply with the so-called D-3 standards according to the German tax legislation based on the current NEDC, being equivalent to the EURO 3 standards based on the modified NEDC, but not including all the extended EURO 3 requirements) and Euro 4 cars benefit from tax relief until 31.12.05 or until it reaches 250 DM (petrol) or 500 DM (diesel) for Euro 3 cars and 600 DM (petrol) and 1200 DM (diesel) for

Euro 4 cars. Tax relief for Euro 3 cars applies from 1.7.97, but for Euro 4 applies from 2000 on as soon as emission values have been determined in Brussels. It is especially significant that the EU Commission approved this package prior to completing action on the Euro 3 and 4 proposals.

6. Taxation of Vehicles and Fuels in Denmark

a. Passenger cars

In the existing system the car owners have to pay an yearly tax based on the weight of the car. 7 different classes are defined. A typical vehicle in Denmark belongs to the group 801 - 1,100 kg with a yearly rate of Dkr. 2,260 for gasoline cars and Dkr 3,472 for diesel cars [14]. From 1st July 1997 the yearly tax will be based on energy consumption measured according to directive 93/116 instead of weight. 24 classes are defined for both gasoline and diesel cars. Examples of selected classes (basis 1997) are given below (the figures will be increased with inflation plus 1.5% every year):

	Class	Km pr. liter	Yearly tax (Dkr.)
Petrol	1	above 20.0	200
	11	10.0-10.5	2,200
	24	below 4.5	7,400
Diesel	1	above 22.5	790
	12	10.2-11.3	3,890
	24	below 5.1	10,130

It is estimated that the new system will give approximately the same income as the earlier one.

b. Gasoline

Today the taxation of unleaded gasoline is fixed to Dkr. 3.32 pr liter (excluding 25% VAT). For leaded gasoline the figure is Dkr. 3.97 pr liter. As a result leaded gasoline has been removed from the market since March 1994. Since 1995 incentives (Dkr 0.03 pr liter) have been given to gasoline delivered from stations equipped with vapor recovery systems. From 1st of January 1998 (or after approval from the Commission) differentiation will be introduced according to the content of benzene. The following figures have been decided:

Benzene (%)	Differentiation (Dkr/l)
below 1	-0.04
1-2	-0.02
2-3	0.00
3-4	+0.02
4-5	+0.04

c. Light commercial vehicles

In the new system incentives will be given to light commercial vehicles for which it can be demonstrated that they meet the proposed future EURO 3 (2000) or EURO 4 (2005) standards. The

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14/For conversion 100 Dkr = 15.2 US-dollars = 13.4 ECU

reference is the figures given in the Commission proposal COM(97) 61, dated 20th of February 1997.

The Danish system operates with 4 classes based on gross vehicle weight. Examples on the reduction in the yearly taxes for class 1 and 4 are given below:

Class		EURO 3 (Dkr)	EURO 4 (Dkr)
1 (below 1,000 kg)	1998-2000	350	450
	2001	0	100
	2002-2005	0	100
4 (2,500-3,500 kg)	1998-2000	1,150	1,600
	2001	1,150	1,600
	2002-2005	0	450

The system will enter into force 1st of January 1998 (or after approval from the Commission). It is the intention to introduce the same system for passenger cars at a later date.

7. Miscellaneous Central and Eastern European Countries

Summary Table

Country	Vehicle Type	Effective Date	Emission Limits
Bulgaria	Passenger Cars & Light Duty < 3.5t	1979	ECE R 83.01
	Heavy Duty > 3.5t	1981	ECE R 49.02
	Motorcycles	1979	ECE R 40.01
	Mopeds	1982	ECE R 47
Russian Federation (Commonwealth of Independent States)	Passenger Cars & Light Duty < 3.5t	1996	ECE R 83.02
	Heavy Duty > 3.5t	19871996	ECE R 24.03 ECE R 49.02
	Motorcycles	1987	ECE R 40.01
	Mopeds	1987	ECE R 47
Croatia	Passenger Cars & Light Duty < 3.5t	1985	ECE R 83.02
	Heavy Duty > 3.5t	1985	ECE R 49.02
	Motorcycles	1988	ECE R 40.01
	Mopeds	1985	ECE R 47
Czech & Slovak Republics	Passenger Cars & Light Duty < 3.5t	1995	ECE R 83.02
	Heavy Duty > 3.5t	19861992	ECE 24.03 ECE 49.02
	Motorcycles	1988	ECE R 40.01
	Mopeds	1982	ECE R 47
Romania	Passenger Cars & Light Duty < 3.5t	199620002002	ECE R 83 ECE R 83.01 ECE R 83.02
	Heavy Duty > 3.5t	199419962002	ECE R 49.01 ECE R 24.03 ECE R 49.02B

Country	Vehicle Type	Effective Date	Emission Limits
	Motorcycles	1988	ECE R 40.01
	Mopeds	1996	Ece R 47
Slovenia	Passenger Cars & Light Duty < 3.5t	1996	ECE R 83.02
	Heavy Duty > 3.5t	19941994	ECE R 24.02 ECE R 49.02
	Motorcycles	1995	ECE R 40.01
	Mopeds	1985	ECE R 47

8. Argentina

Because of the Mercosul[15] agreement, the Argentinean program is based closely on the Brazilian program although with a delayed schedule. The department for Natural Resources and Environment will be responsible for issuing the Certificates of Approvals for new vehicles though they are also empowered to delegate this responsibility. The emissions limits will be as summarized below.

AUTOMOTIVE EMISSIONS LIMITS FOR ARGENTINA And BRAZIL FOR LIGHT DUTY VEHICLES (# 2,800 Kg.)

Applicability	**1**	**2**	**2A**	**3**	**1**
YEAR	July 1, 1994	July 1, 1994	Jan. 1, 1995	Jan. 1, 1997	Jan. 1, 1999
Exhaust Emissions					
CO g/km	-	24	12	2	2
HC g/km	-	2.1	1.2	0.3	0.3
NOx g/km	-	2	1.4	0.6	0.6
CO Idle %	3	3	2.5	0.5	0.5
HC Idle ppm	600	600	400	250	250
Fuel Evaporation (g/test)			6	6	6
Crankcase	Zero	Zero	Zero	Zero	Zero
Equivalent To	-	Phase 1	Phase 2	Phase 3	Phase 3
		Brazil	Brazil	Brazil	Brazil
		1988	1992	1997	1997

Applicability:

1. Every Model and Configuration of Argentine manufacture.
2. Every new Configuration of Nationally manufactured or Imported Vehicle
2a. Same as 2, with the exception of vehicles not derived from automobiles.
3. Every new vehicle model manufactured in Argentina or imported.

Heavy Duty Gasoline and Diesel Vehicles

	Emissions (g/kWh)				**%**	**(ppm)**
Model Year	CO	HC	NOx	PM	Idle CO*	Idle HC*
1995	11.2	2.4	14.4	.4/.68	3	660

15/This agreement between Argentina, Brazil, Paraguay and Uruguay forms a Common Market of South America.

	Emissions (g/kWh)				%	(ppm)
Model Year	CO	HC	NOx	PM	Idle CO*	Idle HC*
1997	11.2	2.4	14.4	.4/.68	2.5	400
1996 Urban Buses	4.9	1.23	9	.4/.68	-	-
1998 Diesels	4	1.1	7	.15/.255	-	-

* Gasoline fueled only

9. Australia

Motor vehicle emissions are recognized as major contributors to the air pollution that is now regarded as a serious threat to human health as well as to the amenity of Australia's largest cities. While the introduction of unleaded petrol in 1985 has resulted in generally improved air quality, the number of motor vehicles on roads and vehicle kilometers traveled (VKT) has increased. This trend has the potential to undo to some extent recent improvements in air quality. In the Sydney Greater Metropolitan Region (GMR) there is an increasing concern about high concentrations of pollutants, especially photochemical smog (indicated by ozone) and particles (PM). The main source of these pollutants is motor vehicle emissions.

Various programs are underway at both the Commonwealth and State levels. The objectives of these programs fall into three broad categories:

< lower emissions for new motor vehicles;
< better quality fuel, and
< monitoring of air quality.

The Action for Air plan (launched by the NSW Government in February 1998) sets targets for improved air quality in a number of key areas including motor vehicles and related transport planning issues. The success of the NSW plan relies in part on air quality standards set at the National level, particularly in relation to new motor vehicle emission standards.

a. Current National Program

A review of Australian Design Rules (ADRs) is underway with the purpose of developing stricter emission standards for new motor vehicles delivered to the Australian market. These standards are determined at the Commonwealth level through Australian Design Rules (ADRs). Emission standards relating to petrol and diesel fueled vehicles (ADR 37 and ADR 70 respectively) are currently being reviewed by the Motor Vehicle Environment Committee (MVEC). MVEC has been established under a Memorandum of Understanding between the National Environment Protection Council (NEPC) and the National Road Transport Commission (NRTC) and is the main mechanism for the States to influencing the Commonwealth transport agenda.

MVEC has now been established for a year and is currently developing a strategic plan. In September, MVEC endorsed a Public Comment paper ("Review of Australia's Vehicle Emission Standards") developed by The Federal Office of Road Transport (FORS). The paper assesses the need for new/revised ADRs in the medium term, identifies options available to Australia and makes recommendations. The Prime Minister has made a commitment to "harmonization with international standards" and the Commonwealth has interpreted this to mean harmonization with the European (UN/ECE) standards; consequently the paper proposes using these as the basis for the new design rules.

The Transport Fuel Study is being managed by Environment Australia. The study will seek to determine the impacts of changed fuel specifications for Australia, including the implications for the domestic oil refining industry. Fuel specifications may require some changes for use in motor

vehicles with more advanced emission control technologies.

A Diesel National Environment Protection Measure is currently being moved through NEPC. Contracts for two of the preparatory projects have been awarded and work has now commenced. Project 1 will identify the characteristics of the diesel fleet (project awarded to Cox/Apelbaum Consulting Group). Project 2, Phase 1, will determine the emission performance of in-service diesel vehicles (project awarded to the NSW EPA). A diesel NEPM is considered necessary by NSW due to:

< the growing number of diesel vehicles on Australian roads (contributing a disproportionate amount of air pollution, especially fine particles), and
< the necessity of establishing mandatory national fuel specifications. (Lower emissions from diesel fueled vehicles in-service will only be possible with the availability of low-sulfur fuels.)

Fuel Consumption Labelling is being worked out by the Australian Greenhouse Office (AGO). This scheme was proposed in the Prime Minister's November 1997 statement "Safeguarding The Future". The scheme will require the model specific labeling of motor vehicles for the purpose of showing consumers the rate of fuel consumption. The AGO is yet to submit a package for the implementation of this scheme to MVEC for consideration.

The introduction of Mandatory Fuel Consumption Standards on a fleet average basis is also being progressed by the AGO. The Prime Minister made a commitment to improved fuel efficiency targets of 15% above business as usual by the year 2010. The Federal Chamber of Automotive Industries (FCAI) have expressed concern that the target is unrealistic and there is considerable resistance to proposed mandatory standards from the motor vehicle manufacturing industry generally. The AGO has subsequently commissioned a study to determine the fuel efficiency of the light commercial and 4WD fleet. Another study will seek to identify trends in the fuel efficiency of the Australian fleet.

An Action Agenda on Downstream Petroleum Products has now been established after oil industry representatives expressed concerns over the implications of revised vehicle emission standards on domestic oil refiners. The Department of Industry, Science and Resources are coordinating the Action Agenda, with NSW represented by The Cabinet Office.

b. Current State Programs

As well as participating in a number of National programs, the NSW government has been developing local controls. An Inspection and Maintenance (I/M) program has been jointly developed by the EPA and Roads & Transport Authority. In-service vehicle emissions are often excessive due to inadequate maintenance or the removal, modification or deterioration of pollution controls. The program will be implemented in three stages:

1. RTA testing facilities at Botany and Penrith are currently being upgraded. During stage 1 vehicles identified as having had their emission specifications modified will be targeted for testing.

2. The establishment of a network of privately operated testing facilities across Sydney by 2001 and the mandatory testing of all passenger and light commercial vehicles.

3. The extension of the program to the Lower Hunter and Illawarra in 2004.

The existing Smoky Vehicle Enforcement Program will be augmented to specifically target vehicles identified as the priority target for the mandatory I/M program outlined above.

The NSW Government will purchase an additional 150 CNG buses over the next five years.

The Western Sydney Natural Gas Vehicle project, has been initiated by the Liverpool City Council. The RTA has advised that the Burmah petrol retailer at Liverpool has opened the first public refueling station for natural gas powered vehicles. The RTA are negotiating funding arrangements with the AGO with a view to extending the project and promoting the opening of further refueling sites in Western Sydney.

The EPA, Shell and Caltex (local oil refiners located in NSW) have recently signed an MoU for the production of Low Volatility Fuel (RVP of 70, rather than the current average of 78 for commercial fuel) to be used in Sydney, Newcastle and Wollongong during the Summer months. The lower volatility fuel will result in a 60% reduction in evaporative emissions from motor vehicles during the warmer months.

10. Brazil

AUTOMOTIVE EMISSIONS LIMITS FOR BRAZIL FOR LIGHT DUTY VEHICLES (# 2,800 Kg.)

Exhaust Emissions			
CO g/km	24	12	2
HC g/km	2.1	1.2	0.3
NOx g/km	2	1.4	0.6
Aldehydes		0.15	0.03
PM		0.5	0.5
CO Idle %	3	2.5	0.5
HC Idle ppm	600	400	250
Fuel Evaporation (g/test)	-	6	6
Crankcase	Zero	Zero	Zero
Year	1988	1992	1997

Diesel Passenger Cars are prohibited.

Heavy Duty Vehicles (Grams per kilowatt hour) (R49 Test Procedure)

Effective Date**	**CO**	**HC**	**NOx**	**PM**
34334	4.9	1.2	9	0.7/0.4*
35064	4.9	1.2	9	0.7/0.4*
35795	4	1.1	7	0.15

*0.7 for engines below 85 kW; 0.4 for engines above.
**The phase in schedule for urban buses and domestically produced engines is slower.

11. Canada

In March of 1985, in parallel with a significant tightening of gaseous emissions standards, Canada adopted the US standards for cars and light trucks to go into effect in the 1988 Model Year. Subsequently, Canada also decided to adopt US standards for heavy duty engines for 1988 as well. The US manufacturers have committed themselves to marketing 1991 and subsequent technology heavy duty engines in Canada in the absence of specific regulations.

On December 7, British Columbia enacted the most stringent new vehicle emission standards in Canada, according to provincial leaders, who said the new rules are comparable to the tough industry regulations in place in the state of California.

The new British Columbia automobile emissions law is designed to address the growing threat associated with vehicle pollution, according to Environment, Lands, and Parks Minister Moe Sihota, who unveiled the regulations in a joint announcement with provincial Health Minister Paul Ramsey. The new standards are aimed at reducing pollution by at least 50 percent by the year 2010 and 70 percent by the year 2020 in the heavily populated southwest corner of the province, compared to a baseline of doing nothing, according to a news release.

The regulatory program was enacted under the Waste Management Act and is entitled the British Columbia Motor Vehicle Emissions Reduction Regulation.

Automobile manufacturers have lobbied the government to accept voluntary reduction measures, Sihota said, but he told reporters that legally binding regulations were necessary.

a. Five-Point Program

The five-point program, according to a background report, implements:

- A 1998 emission standard requiring all new vehicles sold in the province to meet current United States federal emission standards, which are more stringent than existing Canadian standards;
- A 2001 emission standard requiring all new vehicles sold in the province to be certified under the tougher “California” low emission standards and for manufacturers to sell a mix of vehicles which produce, on average, 70 percent less of certain pollutants that vehicles on the market today. Additionally, in the year 2005, the automobile industry is required to sell an even cleaner mix of vehicles;
- A regulation for emissions reductions for 1997 to 2000 requiring manufacturers to identify by February 15, 1996, how they will further reduce harmful emissions, including greenhouse gas emissions, from vehicles offered for sale in the years 1997 to 2000;
- Cleaner technology vehicle targets for the proportion of zero-emission and ultra low emission vehicles sold in the province, based on those established for California. In 1998, 2 percent of vehicles should be in this category, with the target rising gradually to 10 percent of vehicles sold by 2003. A Cleaner Technology Vehicle Committee composed of government, industry, and other stakeholders will be established to ensure targets are met; and

- Improved emissions warranty beginning in 1997 that will require auto manufacturers selling vehicles in the province to offer warranties covering all emission-related components for at least two years or 38,000 kilometers and to cover major emission control components, such as catalytic converters, for at least eight years or 120,000 kilometers. These regulations are similar to current U.S. federal requirements.

b. Fines

Studies carried out for the province and for the Canadian Council of Ministers of the Environment indicate the average annual increase in the cost of a vehicle due to the new requirements should range from C$20 to C$100 (US $15-$73) per vehicle per year over its useful life, according to the background report.

An individual who sells a car that fails to comply with the regulation faces maximum fines ranging from C$5,000 to C$25,000 per car ($3,660-$18,300), the background report said.

A manufacturer who fails to comply with the fleet average emission requirements will be subject to a fine of up to C$1 million ($732,000).

British Columbia brought in new gasoline standards November 30, 1995, aimed at reducing air pollution and ensuring gasoline was available for low emission vehicles. The cleaner gasoline regulation establishes standards that will significantly reduce emissions of harmful pollutants such as volatile organic compounds, nitrogen oxides, sulfur oxides, and toxics.

A lower level of sulfur is a key requirement of the regulation which also stipulates a reduction in benzene

12. Chile

Vehicle Type	Effective Date	CO	HC	NOx	PM	Test Cycle
		grams/kilometer				
Passenger Cars	1995	2.11	0.25	0.82	0.125	75 FTP
Light Duty Truck (<3860 kg)	1995	6.2	0.5	1.43	0.16	75 FTP
Heavy Duty Diesel		grams per kilowatt hour				
	Sept '94	4.5	1.1	8	0.36	ECE R 49
	Sept '98	4	1.1	7	0.15	
	Or	Grams per Brake Horsepower Hour				US
	Sept '94	15.5	1.3	6	0.36	
	Sept '98	15.5	1.3	5	0.1	
Heavy Duty Gasoline	Current	37.1	1.9	5	-	
Santiago Urban Bus	Sept '93	15.5	1.3	5	0.25	
	Sept '96	15.5	1.3	5	0.1	
	Or	Grams Per Kilowatt Hour				ECE R 49
	Sept '93	4.5	1.1	8	0.36	
	Sept '96	4	1.1	7	0.15	

Santiago, Chile has a serious diesel particulate problem caused in large part by urban buses. To address this problem it has introduced a stringent smoke inspection program. In addition, it introduced a one day a week ban on driving with exemptions granted only to diesel buses equipped with catalysts or traps. In October of this year, the exemption program was replaced by an auction system designed to reduce the number of buses. Essentially, only 6000 buses have been granted a licence to operate in the center of the city, down from approximately 9000. While the criteria for granting such licenses did not explicitly include emissions, it is intended to include particulate or smoke levels in a follow up program.

13. Colombia

Vehicle Category	Unit	CO	HC	NOx	HC+NOx
Light Duty	g/km	2.3	0.25	0.62	
Medium Duty	g/km	11.2	1.05	1.43	
Heavy Duty	g/bhp-hr	25			10

14. Hong Kong

< Encouraged by a price differential of 1 HK$ per liter price reduction for unleaded petrol compared to leaded, unleaded petrol is now responsible for 71% of total petrol sales. Notably, the benzene content of the unleaded petrol is only 3.44%, virtually the same as leaded petrol.

Hong Kong Automotive Fuel Specifications		
Starting 1April 1997		
Diesel		
Properties	Range	ASTM Test Method
Sulphur (% by Wt.)	0.05 Maximum	ASTM D4294
Cetane Number	50 Minimum	ASTM D613
Viscosity (mm2/s)	2.00-4.50	ASTM D445
Distillation (C) at 95%	370 Maximum	ASTM D86
Density (kg/l)	.820-.860	ASTM D1298/4052
Unleaded Petrol		
Properties	Range	ASTM Test Method
Lead (gr/L)	.005 Maximum	ASTM D3237
Sulphur (% Mass)	.05 Maximum	ASTM D1266
Motor Octane Number	85.0 Minimum	ASTM D2700
Research Octane Number	95.0 Minimum	ASTM D2699
Benzene (% Vol)	5.0 % Maximum	ASTM D4420
Methanol (% Vol) (a)	3 % Maximum	ASTM D5599
Ethanol (% Vol) (a)	5 % Maximum	ASTM D5599
Iso-propyl alcohol (% Vol) (a)	5 % Maximum	ASTM D5599
Tertiary butyl alcohol (% Vol) (a)	7 % Maximum	ASTM D5599
Iso-butyl alcohol (% Vol) (a)	7 % Maximum	ASTM D5599
Ethers containing 5 or more carbon atoms per molecule (% Vol) (a)	10 % Maximum	ASTM D5599
Other organic oxygenates (% Vol) (a)	7 % Maximum	ASTM D5599
Mixture of all organic oxygenates (% weight oxygen) (a)	2.5 % Maximum	ASTM D5599

Hong Kong Automotive Fuel Specifications		
Starting 1April 1997		
Diesel		
Properties	Range	ASTM Test Method
(a) ref. Directive 85/536/EEC		

Hong Kong New Petrol Vehicle Exhaust Emission Standards Summary						
	1 January 92	**1 April 95**	**1 April 97**	**1 October 98**	**1 April 99**	**1 October 2000**
Vehicle type				**Proposal**	**Proposal**	**Proposal**
Private Car	Europe ULP Std.(1.10.93); or	*EU Phase 1*; or	*EU Phase 2*; or	EU Phase 2; or	EU Phase 2; or	*EU Phase 3* or
	US 88; or	US 88; or	*US 94*; or	*US 96*; or	US 96; or	US 96; or
	Japan 78	Japan 78	Japan 78	Japan 78	Japan 78; and	Japan 78; and
					Evaporative emissions:	
					EU or US Federal or Japan	EU or US Federal or Japan
Goods vehicles and buses up to 2.5 tonne	Europe ULP Std.(1.10.93); or	*EU Phase 1*; or	*EU Phase 2*; or	EU Phase 2; or	EU Phase 2; or	*EU Phase 3* or
	US 88; or	US 88; or	*US 94*; or	*US 97*; or	US 97; or	US 97; or
	Japan 88	Japan 88	Japan 88	Japan 88	*Japan 94*; and	Japan 94; and
					Evaporative emissions:	
					EU or US Federal or Japan	EU or US Federal or Japan

Hong Kong New Petrol Vehicle Exhaust Emission Standards Summary						
Goods vehicle and buses between 2.5 and 3.5 tonne	Europe Leaded Petrol Std.	*EU Phase 1*; or	*EU Phase 2*; or	EU Phase 2; or	EU Phase 2; or	*EU Phase 3*; or
		US 91; or	*US 94*; or	*US 97*; or	US 97; or	US 97; or
		Japan 92	Japan 92	Japan 92	*Japan 95*; and	Japan 95; and
					Evaporative emissions:	
					EU or US Federal or Japan	EU or US Federal or Japan
Goods vehicle and buses over 3.5 tonne	Europe Leaded Petrol Std.	*US 91*; or	US 91; or	*US 98*; or	US 98; or	*Euro III*; or
		Japan 92	Japan 92	Japan 92	*Japan 95*; and	US 98; or
						Japan 95; and
					Evaporative emissions:	
					EU or US Federal or Japan	

Hong Kong New Diesel Vehicle Exhaust Emission Standards Summary

Vehicle type	1 January 92	1 April 95	1 April 97	1 October 98 Proposal	1 April 99 Proposal	1 October 2000 Proposal
All FAS	K - 2.13	*K - 1.20*	*K - 1.00*	K - 1.00	K - 1.00	*K - 0.8*
Smoke Standard (Light absorption coefficient K/ m^{-1})						
Private Car	Europe Diesel Std.(1.10.93); or US 88; or Japan 90	*EU Phase 1*; or US 88; or *Japan 94*	EU Phase 1; or US 88; or Japan 94	*US California 94*	US California 94	*EU Phase 3*; or US California 94

Taxi	Europe Diesel Std.(1.10.93); or US 88; or Japan 90	*EU Phase 1*; or US 88; or *Japan 94*	EU Phase 1; or US 88; or Japan 94	EU Phase 1; or US 88; or Japan 94	*EU Phase 2*; or *US 96*; or *Japan 98*	*EU Phase 3*; or US 96; or Japan 98
Goods vehicles and buses up to 2.5 tonne	Europe Diesel Std.(1.10.93); or US 88; or Japan 88	*EU Phase 1*; or US 88; or *Japan 93*	EU Phase 1; or US 88; or Japan 93	*EU Phase 2*; or *US 97*	EU Phase 2; or US 97; or *Japan 98*	*EU Phase 3*; or US 97; or Japan 98
Goods vehicle and buses between 2.5 and 3.5 tonne	Europe Smoke Std.	*EU Phase 1*; or *US 88*	EU Phase 1; or US 88	*EU Phase 2*; or *US 97*	EU Phase 2; or US 97	*EU Phase 3*; or US 97
Goods vehicle and buses over 3.5 tonne	Europe Smoke Std.	*Euro I*; or *US 91*	*Euro II*; or *US 94*	Euro II; or *US 98*	Euro II; or US 98	*Euro III*; or US 98

15. Hungary

By the end of 1993, catalytic converters became mandatory equipment on all new cars in Hungary, whether imported or assembled domestically. The government also hoped to persuade owners of older cars to install converters and offered financial assistance (up to 60 percent) of the cost to motorists who did so. Part of the money for this effort came from the European Union's PHARE fund, a fund set up initially to help Poland and Hungary in their economic reconstruction but which has since been broadened to include other Eastern European nations.

The financial assistance was the positive inducement; the negative was that municipalities prohibited cars without catalytic converters from entering the centers of cities under certain conditions. This was left up to municipal administrations, but during a smog alert the national authorities expected that municipalities would ban polluting cars from entering.

The government also took steps toward the elimination of two-stroke engines, usually found in the heavily polluting Trabant auto, the east German product common to many countries in the former Soviet bloc. In 1994, businesses which owned two-stroke-engine vehicles were required to get rid of them. Individuals were encouraged to replace two-stroke vehicles with four-stroke engines or even install catalytic converters for the two-stroke engines. Two-stroke engines put out much more pollution than four-stroke engines.

The city government of Budapest gave away public transportation passes to motorists who turned in their two-stroke-engine automobiles to be destroyed. A second aspect of the same program allowed motorists to sell their Trabants and Wartburgs to the city for a price higher than the going market rate and use the money as part of a down payment on a new, more environmentally friendly car.

The program coordinator of the "green-two-stroke" program has reported that 1,451 owners of the cars-- two-thirds own Trabants and one-third own Wartburgs — have applied to exchange their cars for passes to use in the city's transportation system. For each Trabant, the city awarded four year-long passes; for each Wartburg, six year-long passes were issued. Pass holders can use them on any of the city's public transport systems. The program cost the city 90 million forints (US$918,367).

About 120,000 Trabants and Wartburgs were on Budapest's streets. The two types of cars, made in the former East Germany, are notorious for spewing pollutants into the environment. Because of their low price, they were the cars of choice in Hungary.

At the time of the program's launching, the administration displayed five selected kinds of cars in the city hall's courtyard. Dealers for 43 kinds of cars had submitted their cars for consideration. A committee chose the finalists on the basis of engine characteristics, the existence of a catalytic converter, availability of service, price, and credit conditions. It negotiated with city banks to set up purchase terms. The cars chosen for the program were the SEAT Marbella, Suzuki Swift, Opel Corsa, Renault, and Volkswagen Polo. More than 700 owners of Trabants and Wartburgs sold their cars to the city for coupons worth 20,000 forints ($200) and 33,000 ($333) each, respectively. The motorists could add the coupons to cash for a one-third down payment on one of the five types of

cars. They have the opportunity to pay off the balance of the car's purchase price over five years at annual interest rates of 13 percent to 15 percent, a rate considered highly favorable in Hungary. The cars' prices were 60,000 forints to 190,000 forints ($600-$1,900) lower than their showroom prices.

The Trabants and Wartburgs turned in by the motorists were destroyed. The cost of the program was about 17 million forints ($170,000). Taking more than 2,000 Trabants and Wartburgs off the streets was estimated at the time to eliminate 331,000 kilograms (728,200 pounds) of pollutants per year.

Up-to-date motor vehicle fuel standards went into effect in April 1993. They defined three types of diesel fuels: standard; with low sulfur content; and with low sulfur and aromatic contents, and four types of gasoline:

unleaded gasolines: 91 and 95 RON
leaded gasolines: 92 and 98 RON.

A so called "environmental product charge" went into effect for fuels. The gasoline and diesel oils sold within the national territory are required to pay these charges which are:

a) for gasoline 667 -HUF/ton (about 11 CHF)

b) for diesel 595 HUF/ton (about 10 CHF).

The "environmental product charge" is paid into a Fund which is dedicated to the moderation and prevention of the damages caused by motorization.

The rate of division of these dues in %:

a) Giving initiative to take measures for decreasing the pollution caused by motor vehicles: - 32%

b) The development of the transport infrastructure with the aim of environmental protection - 23%

c) Management of scrap/wrecked vehicles - 10%

d) Stimulation of the spread of environment friendly transport types and products: - 30%

e) Improving the attitude of the society to the environment protection: - 5%

Hungary introduced an additional series of changes to fuel composition and properties as of 1 January 1997:

< 1. The benzene content of the unleaded gasolines was been reduced from 3% (Vol.) to 2% (Vol.) according to the Hungarian standard MSZ 11793, in harmony with the EU standard EN 228.

< 2. a.) The sulfur content of diesel fuel was also reduced from 0.2% (Mass) to 0.05% (Mass) according to the Hungarian standard MSZ 1627, in harmony with the Directive 93/12/EU,

< 2. b.) The value of the cold filtering feature (CFPP) of the diesel fuels for the cold season (winter) was modified at the same time from - 12C to -15C.

A new national decree went into effect as of 1 January 1996 concerning the environmental features of motor vehicles. This was required due to the increasing pressure exerted by the air pollution and noise in inhabited areas. The establishment of modified rules was also supported by the obligation of harmonization of the laws and rules accepted by Hungary in the contract of an associate membership to the EU. The application of new national rules and regulations was unavoidable in certain areas (e.g. heavy goods, vehicles and buses), for there were initiatives and movements in some West European countries to prohibit the international traffic on their territories of motor vehicles not conforming to their environment protecting rules.

The main guiding principles of the modification of national rules and regulations for Hungary were the following:

< the environment protecting conditions for granting a national type approval or registration and entry into service of a motor vehicles shall be identical with the relevant ECE regulations at any time in force;
< the validity of a national type-approval is limited to three (3) years, but its effect shall be appropriately shortened if the relevant international regulations are rendered more severe in the meantime;
< contrary to the practice up to the present, only a reference is made to the relevant paragraph(s) of the international regulations;
< the relevant requirements are equivalent for imported vehicles independently of the mode of import. Thus the environmental requirements shall be the same for motor vehicles imported, as for those registered and entered into service based on a type-approval certificate;
< in the interest of an efficient applicability, the requirements for motor vehicles in use were simplified but in all cases deduced from the international regulations.

The law requires, as a criterion of registration and/or entry into service from 1 January 1996 that new motor vehicles shall be equipped with closed-loop three-way catalytic converters.

New definitions are listed in the new decree:

< “Silent motor vehicle” means a goods vehicles, road tractor or bus meeting the relevant noise requirement in force.

< “Slightly polluting motor vehicle” means a goods vehicles, road tractor or bus meeting the relevant gaseous and particulate emissions requirements in force.

< “Environment-friendly motor vehicle” means a goods vehicle, road tractor or bus conforming to the regulation which meets the requirements of the above mentioned two definitions simultaneously.

These new definitions have opened the ways for new regulatory work: i.e. the local authorities are empowered to introduce prohibition against the traffic of goods vehicles during night time or in certain areas or can provide a differentiated prohibition of traffic during a smog-alarm. It is to be noted that these differentiating measures are already incorporated in the smog-alarm provisions of Budapest. Those motor vehicles could be exempted from a still-stand during a smog-alarm, which would be in conformity with the new national requirements in force. The new decree defines also reasonable emission limit values for motor vehicles types in use and equipped with positive ignition engine.

List of ECE regulations whose requirements are demanded by national law in Hungary

ECE Regulation		EU Equivalent	Affected Vehicle Category	Term of applicability by national law*
24	03		Heavy Duty (Smoke)	
40	00		MC	31.12.1997
	01		MC	
41	01		MC	31.12.1996
	02		MC	
47	00		Mopeds	
49	00		HD	01.07.1996
	01	88/77/EEC	HD	31.12.1996
	02/A	91/542/EEC	HD	31.12.1997
	02/B	91/542/EEC		
83	00		LDV	01.07.1996
	01/A	91/441/EC	LDV	31.12.1996
	01/B and C	91/441/EC	LDV	31.12.1999
	02	93/59/EC	LDV	

*Note: after the indicated date the regulation amended by the subsequent series of amendment(s) will be mandatory by national law.

The national type-approval certificates issued for motor vehicles not equipped with an exhaust gas after treatment device (i.e. catalytic converter) will cease to be valid from April 1996, but remain in force for vehicles with installed special equipment to 1 January 1997.

16. India

a. New Vehicle Standards

Category	Standards Effective		Proposed Standards	
	1991	**35155**	**1997**	**36616**
Petrol Vehicles (gms/Km)				
Two-Wheelers				
CO	15-35	4.5		2
HC	36079	3.6#		2.0#
Three-Wheelers				
CO	40	6.8		4
HC	15	5.40#		2.0#
Passenger Cars				
CO	14.3-27.1	8.68-12.40	4.34-6.20	2.72
HC	2.0-2.9	3.0-4.36#	1.5-2.18	0.97#
Diesel Vehicles (g/kWh)				
GVW>3.5t				
CO	14	11.2		4.5
HC	3.5	2.4		1.1
NOx	18	14.4		8
PM				0.36
GVW<3.5t				
CO	14	11.2		4.5 or 2.72 g/km
HC	3.5	2.4		1.1

Category	Standards Effective		Proposed Standards	
NOx	18	14.4		8
or				
HC+NOx (g/km)				0.97
PM				0.61 or 0.14 g/km

= HC+NOx

In addition, new light duty vehicles sold in the four Metros (Delhi, Mumbai, Calcutta and Chennai) have been required to be fitted with catalytic converters and to meet standards 50% less than the national norms since April 1, 1995. As of June 1, 1998, this catalyst requirement will be expanded to all major cities of the country.

b. Fuels Requirements

The current plans with regard to fuels' requirements are summarized below.

FUEL	METROS	TAJ TRAPEZIUM	STATE CAPITALS	ENTIRE COUNTRY
Low Sulfur Diesel				
Up to 0.5%	35155	35155		
Up to 0.25%		35308		36250
Low Lead Petrol (0.15 g/liter)	34485	34942		December 1996
Unleaded Petrol (0.013 g/liter)	34789	34789	36159	36615

c. In Use Vehicles

With regard to in use vehicles, all 4-wheel petrol fueled vehicles are required to meet a standard of 3.0% CO when measured at idle; 2 and 3 wheel vehicles must meet a standard of 4.5% CO. With regard to diesel vehicles, all but agricultural tractors must meet a smoke density requirement of no more than 75 Hartridge Smoke Units (HSU) when tested at full load, 70% maximum RPM or 65 HSU when tested by the Free Acceleration test. While the government has launched a major initiative regarding these in use requirements, ordering service stations in Delhi to check that each vehicle

has a valid inspection sticker as a condition of selling fuel to them, several people told me that this is generally ignored. Further it is easy to spot large numbers of heavily smoking vehicles by standing on any corner for a short period of time.

d. India Supreme Court Tightens Rules in Delhi

The Indian Supreme Court has issued a new order in response to a report submitted by the Environmental Pollution Control Authority for National Capital region on banning diesel private vehicles.

The Supreme Court's order gives following directions :

1. All private (non-commercial) vehicles which confirm to EURO II norms may be registered in the NCR without any restriction.

2. All private (non-commercial) vehicles shall confirm to EURO I norm by 1st June, 1999. All private (non-commercial) vehicles shall confirm to EURO II norms by 1st April, 2000. Vehicles may in the meanwhile be registered in the manner indicated below :

3. With effect from 1st May, 1999, 250 diesel driven vehicles per month and 1250 petrol driven vehicles per month may be registered on first - come - first-served basis in the NCR till 1st April, 2000 only if they confirm to EURO I norms. (This is only about one-third of the typical monthly sales of 4000 to 5000.) From 1st April, 2000 no vehicle shall be registered unless it conforms to EURO II norms.

17. Japan

Japanese standards for passenger cars fueled by gasoline or LPG have been stable for many years. Currently applicable regulations are summarized below.

Current Japanese Exhaust Emission Standards for Passenger Cars.

Spark Ignition Engines[1]			
Test Cycle	Emissions	Units	1978 Standards[2,3]
			Mean[4] Max.[5,6]
10-15 Mode[2] Hot Start Test	HC CO NOx	g/km g/km g/km	0.25 0.39 2.1 2.7 0.25 0.48
11-Mode Cold Start Test	HC CO NOx	g/test g/test g/test	7.0 9.5 60.0 85.0 4.4 5.0
	Evap. CC EM	g/test	2.0 0
Idle Idle	HC CO	ppm % vol	1200 4.5
Diesel Engines			
		Until 3.31.00	After 4.1.00
Smoke Test[7] 3-Mode Free Accel.	Blackness of Filter Paper	40%	25%

10-15 Mode[2] Hot Start Test	Ref Mass [kg]	Mean[4, 8] Max[6, 8]	Mean[4] Max[5,6]
	<1265 HC	0.40 0.62	0.40 0.62
	CO	2.10 2.70	2.10 2.7
	NOx	0.50 [a] 0.72 [a]	0.40 [b] 0.55 [b]
	PM	0.20 [a] 0.34 [a]	0.08 [b] 0.14 [b]
	HC	0.40 0.62	0.40 0.62
	>1265 CO	2.10 2.70	2.10 2.70
	NOX	0.60[a] 0.84[a]	0.40 [c] 0.55 [c]
	PM	0.20 [a] 0.34 [a]	0.08 [c] 0.14 [c]

Notes: CC-EM = Crankcase Emission:

1. Covers vehicles [no mass limitation] which serve exclusively for the transport of passengers [maximum 10 people].

2. New Hot Start Test (10-15-Mode) superseded the 10-mode test with effect from 1.11.91 for new models. 1.4.93 for importers. The exhaust emission limits remain unchanged.

3. 80 000 km durability run optional; acceptance of US durability run possible. Advantage: if standards are met over 80,000 km, the mandatory periodic catalyst change does not apply. Alternatively certification is allowed with a 30 000 km durability run and demonstration of compliance over 45 000 km [by extrapolation].

4. To be met as a type approval limit and as a production average (for production control 1% of production has to be tested). If sales exceed 2000 per vehicle model per calendar year, the $_{NOx}$ standards are only applicable if reference mass >1000 kg.

5. To be met as a type approval limit if sales are less than 2000 per vehicle model per calendar year and generally as an individual limit in series production. For gasoline and diesel engines (Hot Start Test only) deterioration factors from the durability runs have to be applied.

6. Applicable for simplified certification procedure if sales are less than 1000 per vehicle model per calendar year without durability run. Exhaust emission testing is necessary for every 50th production example per vehicle model.

7. 3 Mode: Full load smoke test at three specified engine speeds.
   Free Acceleration: Start from idle, integrated smoke measurement over a 15 second cycle, (4 sec. maximum acceleration, followed by 11 sec. coast).

8. Effective Dates
   Domestic Manufacturers: 1.10.86 (Manual transmission); 1.10.87 (Automatic transmission)
   Importers: 1.04.88 (Manual transmission); 1.10.89 (Automatic transmission)

a. Effective Dates
   Domestic Manufacturers
   Reference Mass <1265 kg): 1.10.94 - New models; 1.4.95 - Existing models

Reference Mass> 1265 kg):1.10.94 - New Models; 1.4.95 Existing models
Importers:
Reference Mass < 1265 kg - 1.4.96 > 1265 kg. - 1.4.96; Effective Date for PM limit: 1.4.96.

b. Effective Dates
Domestic Manufacturers - 1.10.98 (New models); 1.9.99 (Existing models)
Importers 1.4.00

c. Effective Dates
Domestic Manufacturers - 1.10.97 (New models); 1.7.99 (Existing models)
Importers 1.4.00

For gasoline trucks, standards are as follows:

Vehicle Category	Test Procedure	CO	HC	NOx	Year of Implementation
1.7t<GVW<3.5 Tons	10-15 Mode 11 Mode	6.50 76.0	0.25 7.00	0.4 g/km 5.0 g/test	1994
GVW>3.5 Tons	G-13 Mode	51	1.8	4.5 g/kWh	1995

NEW TARGET VALUES FOR PERMISSIBLE LIMITS FOR GASOLINE AND LPG MOTOR VEHICLES) (Exhaust Emissions)

Category of Motor Vehicles	Target Values of Permissible Limits (Mean Values)			Measurement Method
	Nitrogen Oxides	Hydro carbons	Carbon Monoxide	
Ordinary-sized, small-sized and mini-sized motor vehicles fueled by gasoline or LPG and used exclusively for carriage of passengers with a passenger capacity of 10 persons or less (excluding two-wheeled motor vehicles)	0.08	0.08	0.67	10-15 Mode (g/km)
	1.4	2.2	19	11-Mode (g/test)
Mini-sized motor vehicles (trucks) fueled by gasoline or LPG (excluding those used exclusively for carriage of passengers, those with 2-stroke engine, and two-wheeled motor vehicles)	0.13	0.13	3.3	10-15 Mode (g/km)
	2.2	3.5	38	11- Mode (g/test)

Category of Motor Vehicles		Target Values of Permissible Limits (Mean Values)			Measurement Method
Ordinary-sized and small-sized motor vehicles (trucks) fueled by gasoline or LPG (excluding those used exclusively for carriage of passengers with a passenger capacity of 10 persons or less and two-wheeled motor vehicles)	Those with a gross vehicle weight of 1700 kg or less	0.08	0.08	0.67	10-15 Mode (g/km)
		1.4	2.2	19	11-Mode (g/test)
	Those with a gross vehicle weight in excess of 1700 kg but 3500 kg or less	0.13	0.08	2.1	10-15 Mode (g/km)
		1.6	2.2	24	11-Mode (g/test)
	Those with a gross vehicle weight in excess of 3500 kg	1.4	0.58	16	Gasoline 13-Mode (g/kWh)

Implementation Schedule: Light Duty Passenger Vehicles & Trucks (<1.7t) - New Type - October 1, 2000, Vehicles Currently in Production & Imports - September 1, 2002
Medium (1.7-3.5t) & Heavy Duty Trucks (>3.5t) - New Type - October 1, 2001, Vehicles Currently in Production & Imports - September 1, 2003
Mini Sized Trucks -New Type - October 1, 2002, Vehicles Currently in Production & Imports - September 1, 2003

Target Values for Permissible Limits for Gasoline Motor Vehicles (Evaporative Emissions)

Category of Motor Vehicles	Target Values of Permissible Limits (Upper Limit)	Measurement Method
Ordinary-sized, small-sized and mini-sized motor vehicles fueled by gasoline (excluding two-wheeled motor vehicles)	2.0 Grams/Test	Method Provided For In Attached Table

DURABILITY RUNNING DISTANCE FOR GASOLINE And LPG MOTOR VEHICLES

Category of Motor Vehicles	Durability Running Distance
Ordinary-sized and small-sized motor vehicles fueled by gasoline or LPG (excluding those with a gross vehicle weight in excess of 3500 kg except for those used exclusively for carriage of passengers with a passenger capacity of 10 persons or less) and two-wheeled motor vehicles)	80,000 km
Ordinary-sized and small-sized motor vehicles fueled by gasoline or LPG with a gross vehicle weight in excess of 3500 kg (excluding those used exclusively for carriage of passengers with a passenger capacity of 10 persons or less and two-wheeled motor vehicles)	180,000 km
Mini-sized motor vehicles fueled by gasoline or LPG (excluding two wheeled motor vehicles)	60,000 km

FUEL EVAPORATIVE EMISSION TEST PROCEDURE TO BE APPLIED TO GASOLINE MOTOR VEHICLES

Fuel Evaporative Emission Test Procedure To Be Applied To Ordinary-Sized Motor Vehicles, Small-Sized Motor Vehicles and Mini-Sized Motor Vehicles Fueled by Gasoline (Excluding two-wheeled motor vehicles)

1	Running	The 11-mode running is conducted at a room temperature of 25 +/- 5°C. Then, the vehicle is driven by repeating the 10-15-mode running three times.
2	Measurement (Hot Soak Loss (HSL))	The mass of hydrocarbons generated inside the SHED for 1 hour is measured at a room temperature of 27 +/- 4 °C.
3	Measurement (Diurnal Breathing Loss (DBL))	The mass of hydrocarbons generated inside the SHED for 24 hours is measured. In this case, the room temperature shall be 20° C at the time of the measurement start. Then, the temperature is raised up to 35 °C. After a lapse of 24 hours, the temperature shall be 20 °C.

EXHAUST EMISSION MEASUREMENT MODE
TO BE APPLIED TO DIESEL OFF - ROAD MOTOR VEHICLES

The mode refers to a method which measures the mass of motor vehicle exhaust gas per unit time and unit work done, following the procedure given below: The sum of the weighted values of the mass of motor vehicle exhaust gas per unit time which is contained in emissions emitted from the exhaust pipe when the vehicle is driven according to each driving condition provided for in the left column of the table below is divided by the sum of the weighted values of the work done generated when the vehicle is driven according to each driving condition provided for in the left column of the same table.

Here, the weighted values can be obtained by multiplying the mass or the work done by the coefficient specified in the right column of the same table.

Driving Conditions	Coefficient
Condition in which the engine is operated with the full-load and at a speed of revolution at which the engine produces its rated output	0.15
Condition in which the engine is operated with a 75% load of the full-load and at a speed of revolution at which the engine produces its rated output	0.15
Condition in which the engine is operated with a 50% load of the full-load and at a speed of revolution at which the engine produces its rated output	0.15
Condition in which the engine is operated with a 10% load of the full-load and at a speed of revolution at which the engine produces its rated output	0.1
Condition in which the engine is operated with the full-load and at an intermediate engine revolution speed (Note)	0.1
Condition in which the engine is operated with a 75% load of the full-load and at an intermediate engine revolution speed (Note)	0.1
Condition in which the engine is operated with a 50% load of the full-load and at an intermediate engine revolution speed (Note)	0.1
Condition in which the engine is idling with no-load	0.15

(Note)
In cases where the engine revolution speed at which the engine produces its maximum torque is within a range of 60% to 75% of the rated engine revolution speed, that engine revolution speed shall be regarded as the intermediate engine revolution speed. However, if the engine revolution speed at which the engine produces its maximum torque is 60% or less of the rated engine revolution speed, the intermediate engine revolution speed shall be 60% of the rated engine revolution speed.

Moreover, if the engine revolution speed at which the engine produces its maximum torque is 75% or more of the rated engine revolution speed, the intermediate engine revolution speed shall be 75% of the rated engine revolution speed.

TARGET VALUES FOR PERMISSIBLE LIMITS FOR DIESEL OFF ROAD MOTOR VEHICLES

Category of Motor Vehicles		Nitrogen Oxides g/kWh	Hydrocarbons g/kWh	Carbon Monoxide g/kWh	Particulate Matter g/kWh	Measurement Method
Diesel Off-Road Vehicles	Those with a rated output of 19 kW or more, but less than 37 kW	8	1.5	5	0.8	Measurement mode provided for in Table Above
	Those with a rated output of 37 kW or more, but less than 75 kW	7	1.3	5	0.4	
	Those with a rated output of 75 kW or more, but less than 130 kW	6	1	5	0.3	
	Those with a rated output of 130 kW or more, but less than 560 kW	6	1	3.5	0.2	

The Japanese EPA continues to move forward with their regulation of diesel vehicles. The Long Term Targets identified in 1989 are being phased in over the period from 1997 to 1999 as follows:

Vehicle Category	NOx	Particulate	Year of Implementation
GVW< 1.7 Tons	0.4 g/km	0.08 g/km	1997
1.7<GVW< 2.5 Tons (M)	0.7 g/km	0.09 g/km	1997
1.7<GVW< 2.5 Tons (A)	0.7 g/km	0.09 g/km	1998
2.5<GVW<3.5 Tons	4.5 g/kWh	0.25 g/kWh	1997
3.5<GVW<12 Tons	4.5 g/kWh	0.25 g/kWh	1998
Above 12 Tons	4.5 g/kWh	0.25 g/kWh	1999

On December 14th, 1998, the Air Quality Committee, Central Council for Environmental Pollution Control issued the new Short Term Targets for diesel vehicle pollution control. The new limits are as follows.

Vehicle Category	Test Procedure (Unit)	Component	Current Limit		New Short Term Target	
			Enforcement Year	Limit Value	Enforcement Year	Target Value
Small Sized Cars ~1.25 tons[1]	10-15 Mode (g/km)	NOX	1997	0.4	2002	0.28
		PM		0.08		0.052
		HC	1986	0.4		0.12
		CO		2.1		0.63
Medium Sized Cars 1.25 tons~[1]		NOx	1998	0.4		0.3
		PM		0.08		0.56
		HC	1986	0.4		0.12
		CO		2.1		0.63
Light Duty Trucks, Buses ~1.7 tons[2]		NOX	1997	0.4		0.28
		PM		0.08		0.052
		HC	1988	0.4		0.12
		CO		2.1		0.63

Vehicle Category	Test Procedure (Unit)	Component	Current Limit		New Short Term Target	
Light Duty Trucks, Buses 1.7~2.5 tons[2]	D13 Mode (g/kWh)	NOX	1997&1998	0.7	2003	0.49
		PM		0.09		0.06
		HC	1993	0.4		0.12
		CO		2.1		0.63
Heavy Duty Trucks, Buses 2.5~12 tons[2,3]		NOx	1998	4.5	2003	3.38
		PM		0.25		0.18
		HC	1994	2.9		0.87
		CO		7.4		2.22
Heavy Duty Trucks, Buses 12 tons~[2,4]		NOx	1994	6.00 (DI)	2004	3.38
				5.00 (IDI)		
			1999	4.5		
		PM	1994	0.7		0.18
			1999	0.25		
		HC	1994	2.9		0.87
		CO	1999	7.4		2.22

(1) Division is made according to the equivalent inertia weight (EIW)
(2) Division is made according to gross vehicle weight (GVW)
(3) Year 1997: GVW 2.5 ~ 3.5 tons; Year 1998: GVW 3.5 ~ 12 tons
(4) DI: Direct Injection; IDI: Indirect Injection

With these short term targets, NOx emissions will be reduced by 25 to 30 percent and particulate matter by 28 to 35 percent over a period from the year 2002 to 2004. Moreover, with a view to maintaining adequate performance of exhaust emissions controls in use, the durability requirements will be extended (see Table below) and the installation of OBD systems will become mandatory.

Expected control technologies include oxidation catalysts, cool EGR, high pressure fuel injection,, intercooling and Turbocharging.

Consideration was also given to modification to diesel fuel quality needs for new technologies such as NOx reduction catalysts but no decision was made to reduce sulfur levels (from 500 ppm) or to modify Cetane number, aromatics content, density, etc. at this time. Also, additional review will be needed before changes to the existing test procedures can be recommended.

Vehicle Category		Passenger Cars	Trucks and Buses (Gross Vehicle Weight)				
			~2.5 tons	~3.5 tons	~8 tons	~12 tons	12 tons[1]
Durability Running Distance	Current	30,000 km	20,000 km	30,000 km			
	After Revision	80,000 km			250,000 km	450,000 km	650,000 km

(1) Current 12 Tons~: To be enforced after year 1999

In addition, automobile manufacturers and petroleum refiners are to carry out technical development so that further reduction of the emissions by an additional 50% beyond the short term targets can be achieved by around 2007. The specific limits and fuel requirements will be determined by the end of 2002.

18. Malaysia

Type Approval Standards For Light Duty Vehicles

Pollutant	91/441/EEC	94/12 EC		
Year	35430	36525		
		Gasoline	Diesel	DI Diesel
CO (g/km)	2.72	2.2	1	1
HC + NOx (g/km)	0.97***	0.5	0.7	0.9
PM (g/km)*	0.14***		0.08	0.1
Evap. HC**	2.0 g/test	2.0 g/test		

* Diesel Only
** Gasoline Only
*** For DI Diesels, standards increased by factor of 1.4 until 7/1/94

Light Duty Trucks (93/59/EEC)

Class Of Vehicle	Fuel	CO	HC+NOX	PM*	Date of Application
Class 1 (<1250 Kg)	All	2.72	0.97	0.14	35430
Class 2 (1251< >1700)	All	5.17	1.4	0.19	35430
Class 3 (<1700 Kg)	All	6.9	1.7	0.25	35430

* Diesel Vehicles Only

19. Mexico

Emission standards for Mexico in g/mile
(FTP test procedure)

Vehicle Type	HC	CO	NOX
1989 cars only	3.20	35.2	3.68
1990 cars	2.88	28.8	3.20
GVW up to 6012 lbs [1]	3.20	35.2	3.68
GVW 6013-6614 lbs [2]	4.80	56.0	5.60
1991 cars	1.12	11.2	2.24
GVW up to 6012 lbs [1]	3.20	35.2	3.68
GVW 6013-6614 lbs [2]	3.20	35.2	3.68
1992 cars	1.12	11.2	2.24
GVW up to 6012 lbs [1]	3.20	35.2	3.68
GVW 6013-6614 lbs [2]	3.20	35.2	3.68
1993 cars	0.40	3.4	1.00
GVW up to 6012 lbs [1]	3.20	35.2	3.68
GVW 6013-6614 lbs [2]	3.20	35.2	3.68
1994 cars	0.40	3.4	1.00
GVW up to 6012 lbs [1]	1.00	14.0	2.30
GVW 6013-6614 lbs [2]	1.00	14.0	2.30

1 Commercial vehicles (e.g. Nissan Vans & Combis)
2. Light Duty Trucks

Heavy duty diesel truck and bus emissions standards have also been adopted and are summarized below.

Heavy Duty Vehicle Emissions Standards
g/bhp-hr

Model Year	HC	CO	NOX	PM
1993	1.3	15.5	5	0.25

Model Year	HC	CO	NOX	PM
1994-1997				
Large Buses	1.3	15.5	5.0	0.07
Medium Buses	1.3	15.5	5.0	0.10
1998 & Later				
Large Buses	1.3	15.5	4.0	0.05
Medium Buses	1.3	15.5	4.0	0.10

For a number of vehicle categories such as heavy duty gasoline trucks and buses and motorcycles, no standards apply to new vehicles at present.

In use vehicle standards also apply to vehicles subjected to the annual I/M program. As noted earlier, these standards were recently tightened by approximately 30%. The standards applicable in the DDF prior to January 1995 are as follows.

In Use Emissions Limits For Passenger Cars

Model Year	HC (ppm)	CO (%)
1979 & Older	700	6
1980-1986	500	4
1987-1993	400	3
1994 and Newer	200	2

In Use Emissions Limits For Combis and Light Trucks

Model Year	HC (ppm)	CO (%)
1979 & Older	700	6
1980-1985	600	5
1986-1991	500	4
1992-1993	400	3
1994 and Newer	200	2

The new standards applicable in the DDF at present are as follows.

In Use Emissions Limits For Passenger Cars

Model Year	HC (ppm)	CO (%)
1979 & Older	450	4
1980-1986	350	3.5
1987-1993	300	2.5
1994 and Newer	100	1

In Use Emissions Limits For Combis and Light Trucks

Model Year	HC (ppm)	CO (%)
1979 & Older	600	5
1980-1985	500	4
1986-1991	400	3.5
1992-1993	350	3
1994 and Newer	200	2

20. People's Republic of China

China has been developing a motor vehicle clean air srategy for the past several years. Several potential scenarios were developed to represent packages of measures for all categories of new vehicles. In selecting strategies to be adopted, several factors were taken into account, including the following:

< air quality need
< potential effectiveness of the measure
< cost of the measure, including hardware, maintenance and fuel economy
< overall cost effectiveness
< technical feasibility

Considering each of the above factors, the choice came down to two scenarios as summarized below.

Scenario	Vehicle Type	2000	2002	2005
2	Passenger Cars	91/441		94/12
	Light Duty Vehicles	93/59		96/69
	Heavy Duty Vehicles	Euro 1		Euro 2
	Motorcycles	ECE 40.01		Japan
4	Passenger Cars		94/12	
	Light Duty Vehicles		96/69	
	Heavy Duty Vehicles		Euro 2	
	Motorcycles		Japan	

In comparing the two scenarios, it can be seen that Scenario 4 gets slightly more benefit at slightly less cost.

Scenario	Cumulative NOx Reduction (10^4 tons)	Cumulative Costs (10^6 $)	Cost-Effectiveness ($/Ton)
2	97	441	450
4	120	389	320

The conclusion of the team after considering all these factors as well as the **technological capability** of the domestic vehicle industry was to recommend Scenario 2 as the minimum requirement but to allow option 4 as an alternative and to provide fiscal incentives to encourage Scenario 4 vehicles and engines.

a. Manufacturer Directed Compliance Tools

Standards themselves cannot be expected to achieve their full benefit unless they are enforced. After reviewing the international experience and the alternative approaches used in Japan, Europe, the United States and elsewhere, it was decided that the following compliance tools should be adopted by regulation by NEPA:

i. Type Approval
ii. Quality Control
iii. Conformity of Production
iv. Recall

b. Programs For Existing Vehicles

Similarly, it was decided that NEPA should issue regulations specifying the national policy regarding the following in use vehicle directed programs:

i. Inspection and Maintenance (I/M)

With regard to I/M, the recommendations included the following:

< the I/M test function should be separated from the repair function.
< NEPA should determine the minimum requirements necessary for an adequate I/M facility.
< One of the important criteria to be considered in the approval of I/M facilities is that the personnel should be adequately trained according to criteria determined by the Environmental Protection Bureau (EPB).
< the local EPB will be authorized to issue a certificate to local I/M stations which meet

the national criteria, to monitor performance and if not adequate to withdraw the certificate.

< all I/M stations must collect data and report to the local EPB.

< As new vehicle standards are tightened, NEPA should also set an in use standard to be used in both type approval and I/M programs.

< the idle test may not be adequate for the closed loop, three way catalyst equipped vehicles likely to emerge once 94/12 is implemented and consideration should be given to a more advanced test such as the acceleration simulation mode (ASM) test for these vehicles.

< no personnel can perform I/M unless they have a certificate from EPB demonstrating that they are adequately trained.

Analysis indicated that the I/M program is one of the most cost effective options considered and one which could have a rapid impact. After 2002, the ASM test will be adopted for catalyst equipped vehicles and 100% of the vehicles will be required to be tested and 100% will need to pass the test in order to be driven. In combination with new vehicle standards, this will enable the NOX targets to be approximately achieved.

ii. Retrofit

It had been proposed that national retrofit regulations should be issued for two primary reasons:

< to assure that retrofit programs being introduced around the country are adequately considering important factors such as fuel quality and vehicle maintenance.

< to assure that retrofits actually achieve the claims made by retrofit companies.

The final report recommends that a performance standard be used as a basis for approving systems.

iii. Scrapping Standards

Vehicles which are unable to pass the I/M program will be required to be scrapped.

iv. Registration and Licensing

A mechanism must be installed to assure that only vehicles which are properly covered by a valid certificate are registered.

c. Fuels

Lead in gasoline will be banned by 2000. NEPA should issue regulations regarding the quality of fuels and fuels additives and enforce these standards and specifications in the fuel distribution system.

d. Non Technical Measures

In addition to technical measures, cost-effective non technical measures should be developed. These types of measures should normally be implemented locally. However, national support through technical investigations, financing and necessary legislation are also needed.

e. Management Plan To Address These Problems

The project group has concluded that the technical measures will be most effective if NEPA is authorized to supervise enforcing the vehicle and fuels emissions regulations and standards which they adopt; this includes the imposition of sanctions and the withdrawal of certificates which allow vehicles to be sold. EPA should also participate with Security, Transportation and the Trade Ministries as well as Ministry of Machine Industry (MMI) and the Petrochemical industry in a Management Team to coordinate with all other relevant Government Ministries in developing and implementing its regulations. A parallel organizational structure should also exist at the municipal level in the major cities.

i. Mobile Sources Management Office

If NEPA is given the full responsibilities recommended above, the project team further recommends that a new Mobile Sources Management Office (MSMO) be created within NEPA to develop and implement the motor vehicle pollution control regulations. After considering other programs in other countries, it appears that the **minimum** staffing for this office should include the following:

Mobile Source Management Office

Function	Staffing
Certification of Vehicles & Laboratories	3 (people)
Regulations	2 "
Fuels	2 "
Environmental quality	2 "
Overall Management and Supervision	2 "
Minimum Total	11 "

With regard to new vehicles, NEPA will be responsible for drafting the national regulations, setting standards and defining the enforcement criteria; local EPA's will have the option, acting as the agent of NEPA, of carrying out some periodic or random testing or oversight to assure that locally produced vehicles are meeting the nationally set standards.

The agency responsible for China's border, Customs, should be responsible for assuring that **all** vehicles imported into the country - new or used - comply with the **new** vehicle standards and regulations in effect in China at the time the vehicle is imported.

Recognizing that other organizations have certain responsibilities for approval of new vehicles - e.g., MMI for Safety - it was recommended that in granting these approvals, a valid certificate from NEPA is sufficient to assure compliance with emissions requirements; there should be no redundant responsibilities in this regard.

With regard to in use vehicles, it was recommended that the local police and environment departments jointly develop and implement the annual and roadside inspection programs. NEPA should define the national I/M requirements to be then implemented jointly at the local level by the Police/EPA authorities. Local officials could impose more stringent management of in use vehicles - e.g., more frequent or intense random roadside inspections, retrofit requirements, etc. - which are applied to local vehicle users but have no direct impact on vehicle manufacturers.

21. Philippines

Key motor vehicle related elements of the Air Quality Action Plan for the Philippines are summarized below.

a. Unleaded Gasoline

On September 26, 1997, President Ramos signed Executive Order 446 mandating the phase out of leaded gasoline no later than January 1, 2000 in Metro Manila and no later than January 1, 2001 throughout the remainder of the country.

The newly drafted Clean Air Act[16], while not yet adopted or signed would also limit by 2003 the aromatic content of unleaded gasoline to a maximum of 25% by volume and the benzene content to 1% by volume. No organo-metallic additive nor any other additive which would increase emissions of CO, HC or NOX will be allowed.

b. New Vehicle Standards

Pursuant to Section 7 of Presidential Decree No. 1181, the Department of Environment and Natural Resources will soon issue revised rules and regulations regarding motor vehicle pollution which contain more stringent standards for new and used motor vehicles. These require that after January 1, 1997 all newly manufactured gasoline fueled vehicles including motorcycles and mopeds shall be designed to operate on unleaded gasoline.

After January 1, 1997, all new light duty vehicles are required to comply with ECE regulation R15-04 standards as summarized below.

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Reference Mass (kg)	CO G/km	HC + $_{NOX}$ G/km
750	5.8586e+19	19.0
751 - 850		19.0
851 - 1020		19.0
1021 - 1250		20.5
1251 - 1470		22.0
1471 - 1700		23.5
1701 - 1930		25.0
1931 - 2150		26.5
2150		28.0

Notes:

1. Regulation 15 applies to vehicles up to 3.5 t GVW.
2. The constant volume sampling CFI measurement technique was introduced with the 04 Amendment.
3. For Light Duty Vehicles, the HC + NOX limits are those given in the table above multiplied by a factor of 1.25.
4. The limits quoted are those for type approval. Production vehicles are permitted to exceed these figures by up to 20% for CO and up to 25% for HC + $_{NOX}$

New Medium and Heavy Duty engines sold after January 1, 1997 must comply with the ECE Regulation 49-01 which contains the following limits.

CO (g/kWh)	HC (g/KWh)	NOX (g/KWh)
11.2	2.4	14.4

Fuel evaporative emissions for spark ignition engines shall not exceed 2.0 grams per test; likewise, crankcase emissions should be eliminated.

For motorcycles, CO emissions at idle shall not exceed 6.0%

After January 1, 2000, the standards for new cars, light duty vehicles and heavy duty engines

will be required to comply with European Union Directives 91/441, 93/59 and 91/542 (Step 1), respectively. These limits are summarized below.

Exhaust Emission Limits For Cars

CO (g/km)	HC + NOX (g/km)	PM* (g/km)
2.72	0.97	0.14

Exhaust Emission Limits For Light Trucks

Class Of Vehicle	CO	HC+NOX	PM*
Class 1 (<1250 Kg)	2.72	0.97	0.14
Class 2 (1251< >1700)	5.17	1.4	0.19
Class 3 (<1700 Kg)	6.9	1.7	0.25

* Diesel Vehicles Only

Exhaust Emission Limits For Medium and Heavy Duty Engines

CO (g/kWh)	HC (g/KWh)	NOX (g/KWh)	PM (g/KWh)
4.5	1.1	8	0.36

c. In Use Vehicle Standards

A mandatory periodic emissions inspection program will be set up throughout the entire country. It is expected to be operational throughout Metro Manila by mid 1999 and throughout the entire country by mid 2000. Gasoline fueled vehicles will initially be subject to the two speed idle test and diesel vehicles to the free acceleration test

For privately owned light duty vehicles up to 4.5 tons, the first inspection shall commence on the fourth registration year, be biennial until the 12th year and then annual thereafter.

Commercial, public utility and all other vehicles heavier than 4.5 tons will be inspected annually from the second to 4th registration year and semi annually thereafter.

For rebuilt or imported used vehicles, the first inspection shall commence on the first registration year.

Gasoline fueled vehicles registered prior to January 1, 1997 must emit no more than 4.5% CO and 800 ppm HC; new vehicles registered after this date must meet limits of 3.5%CO and 600 ppm HC. New vehicles registered on or after January 1, 200 must meet limits of 0.5% CO and 100 ppm HC at low idle and 0.3% CO with Lambda reading between 1+/-0.03% at high idle.

Diesel fueled vehicles' smoke opacity should not exceed 2.5 m^{-1} if first registered on or before 1/1/1997 except turbocharged engines which can rise to 3.5 m^{-1} or those tested at elevations of 1000 meters and above, 4.5 m^{-1}.

Diesel vehicles registered on or after January 1, 1997 must meet limits of 1.65 m^{-1}, 2.65 m^{-1} and 3.65 m^{-1} for naturally aspirated, turbocharged and high altitudes, respectively.

Diesel vehicles initially registered on or after January 1, 2000 must comply with limits of 1.2 m^{-1}, 2.2 m^{-1} and 3.2 m^{-1} for naturally aspirated, turbocharged and high altitudes, respectively.

Motorcycles registered for the first time on or after January 1, 1997 must meet a limit of 6.0% CO at idle.

Misfueling any vehicles labeled unleaded gasoline only with leaded gasoline is prohibited.

d. Imported Used or Rebuilt Motor Vehicles

Prior to first registration, any imported used or any rebuilt motor vehicles registered for the first time prior to December 31, 1999 shall meet limits of 3.5% CO and 500 ppm HC (spark ignition engines) or 1.65 m^{-1} for diesels. Vehicles registered for the first time on or after 1 January 2000 shall comply with limits of 1.2% CO and 200 ppm HC (spark ignition) or 1.2 m^{-1} (compression ignition). If the in use emission standard of the country of origin is more stringent than these maximum limits, it will supercede them.

e. Clean Diesel Fuel

No later than 18 months after he new Clean Air Act[17] goes into effect, the maximum sulfur

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content of automotive diesel fuel shall be limited to 0.20% by weight and the cetane number to 47 and the cetane index to 55. Not later than January 1, 2003, the maximum sulfur content shall be 0.05%.

22. Poland

Poland has gradually tightened its motor vehicle emission standards over the last five years with a view to harmonizing the requirements with the European Union. A revised regulation specifying emission requirements to be satisfied by new and in-use motor vehicles in Poland came into effect on July 1, 1995. It replaced the old one issued in 1993. The new regulation requires passenger cars and light duty vehicles (having a maximum mass not exceeding 3500 kg, other than cars) equipped with SI engines to meet the standards specified for unleaded vehicles in ECE Regulation 83, 02 series of amendments and introduces integrated with them requirements for in-use vehicles. This way, the process of harmonization of Polish requirements with those force in the EU has been, in principle, completed. The details of the current motor vehicle emission requirements in Poland (as of July 1, 1995) are given below.

a. Emission Requirements For New Vehicles Subject To Type Approval

All newly registered new vehicles the production of which in or import to Poland exceeds 3 units should belong under the approved type and meet the following requirements.

i. Passenger cars and light duty vehicles (Categories M1 and N1)

Standards specified in ECE Regulation 83, 02 series of amendments, approval B (for vehicles fueled with unleaded gasoline) and approval C (for diesel vehicles). These requirements are equivalent to those specified in EU Directive 93/59/EC. Gasoline vehicles having engines with displacement below 700 cc are exempted from meting the above standards until December 31, 1996.

ii. Heavy duty vehicles (maximum mass exceeding 3500 kg)

Requirements specified in ECE Regulation 49, 02 series of amendments (equivalent to EU Directive 91/542/EC). They are in force from October 1, 1993.

iii. Motorcycles

Requirements specified in ECE Regulation 40, 01 series of amendments (in force from November 13, 1992).

iv. Mopeds

Requirements specified in ECE Regulation 47 (in force from November 13, 1992).

b. Emission Requirements For Vehicles Not Subject To Type Approval

Motor vehicles not subject to type approval should undergo a pre-registration inspection. They can be registered only if they meet the requirements specified below for in-use vehicles.

c. Emission Requirements For In-Use Vehicles

i. Vehicles equipped with SI engines

I) for vehicles first registered before October 1, 1986:

CO concentration at idle should not exceed:
- all vehicles except motorcycles - 4.5% vol.,
- motorcycles - 5.5% vol.,

ii) for vehicles first registered on and after October 1, 1986 but before July 1, 1995:

CO concentration at idle should not exceed:
- all vehicles except motorcycles - 3.5% vol.,
- motorcycles - 4.5% vol.,

iii) for vehicles first registered on and after July 1, 1995:

a) all vehicles except motorcycles

CO and HC concentrations measured at idle should not exceed:
- CO 0.5% vol.,
- HC 100 ppm (as hexane NDIR),

CO and HC concentrations measured at raised idle speed (from 2000 to 3000 rpm) should not exceed:
- CO 0.3% vol.,
- HC 100 ppm (as hexane NDIR),

Air fuel equivalence ratio (lambda) measured at raised idle speed should be within 0.97 - 1.03 (for vehicles equipped with lambda probe).

Vehicles having SI engines with displacement below 700 cc are exempted from meeting the above standard until December 31, 1996.

b) motorcycles

CO concentration at idle should not exceed 4.5% vol.

The requirements specified above in items I), ii), and iii) are applicable to passenger cars, light duty vehicles and motorcycles; those specified in item I) also to heavy duty vehicles (maximum mass exceeding 3500 kg).

ii. Diesel Vehicles

The smoke level measured at free acceleration from low idle speed should not exceed:

- naturally aspirated engines - 2.5 m^{-1},
- turbocharged engines - 3.0 m^{-1}.

The above requirements are applicable to the following diesel vehicle categories: passenger cars, light duty vehicles, heavy duty vehicles, agricultural tractors and slow-moving machines.

The compliance with the above in-use requirements is checked during mandatory periodical inspections and nominally also random road-side checks, the frequency of periodical inspections depending on the vehicle category and age. The basic sequence is as follows:

- for passenger cars and light duty vehicles subject to type approval: 3 years from the first re-registration, next after 2 years and every year;
- for passenger cars and light duty vehicles not subject to type approval: every year;
- for trucks having a maximum mass exceeding 3500 kg: every year;
- for buses having more than 15 seats: 1 year from the first re-registration and next every half a year.

Emissions Requirements For New Vehicles Subject to Type Approval

Vehicle Category	ECE Regulation	EU Directive	Date of Applicability
Passenger Cars and Light Duty Vehicles	R83/02 B & C	93/59/EC	34880[18]
Heavy Duty Vehicles	R49/02	91/542/EC	34242
Motorcycles	R40/01	-	33920
Mopeds	R47	-	33920

Emissions Requirements For In Use Vehicles

Vehicle Category	Date of First Registration	Idle CO (%)	Idle HC (ppm)	Air Fuel Equivalence Ratio (λ)	Smoke Level
Spark Ignition Engines (Except Motorcycles)[19]	Before 1/10/86	4.5	-	-	-

18/Gasoline vehicles with engines having a displacement below 700 cc were exempt from these requirements until December 31, 1996.

19/Applicable to Passenger Cars and Light Duty Vehicles For Heavy Duty Spark Ignition Vehicles, CO limits of 4.5% apply..

Vehicle Category	Date of First Registration	Idle CO (%)	Idle HC (ppm)	Air Fuel Equivalence Ratio (λ)	Smoke Level
	Between 1/10/86 and 1/7/95	3.5	-	-	-
	After 1/7/95	0.5	100	.97-1.03	-
Motorcycles	Before 1/10/86	5.5	-	-	-
	After 1/10/86	4.5	-	-	-
Diesel Vehicles[20]	Naturally Aspirated	-	-	-	2.5 m^{-1}
	Turbocharged	-	-	-	3.0 m^{-1}

Motor vehicles not subject to type approval should undergo a pre-registration inspection. They can be registered only if they meet the requirements specified above for in-use vehicles.

Compliance with the above in-use requirements is checked during mandatory periodical inspections and also random road-side checks, the frequency of periodical inspections depending on the vehicle category and age. The basic sequence is as follows:

- for passenger cars and light duty vehicles subject to type approval: 3 years from the first re-registration, next after 2 years and every year;
- for passenger cars and light duty vehicles not subject to type approval: every year;
- for trucks having a maximum mass exceeding 3500 kg: every year;
- for buses having more than 15 seats: 1 year from the first re-registration and next every half a year.

20/Applicable to Passenger cars, Light Duty Vehicles, Heavy Duty Vehicles, Agricultural Tractors and Slow-moving Machines.

23. Romania

Emissions Standards For New Vehicles

Vehicle Category	Standards	Date of Implementation
Light Duty Vehicles (M1&N1)	R83-03 B&C	1/1/98 Imports 1/1/99 Domestic 7/1/98 Individual Imports
Heavy Duty Vehicles	Euro 2	1/1/98 Imports 1/1/99 Domestic 9/1/98 Individual Imports

24. Russia

A system of automobiles certification is in force now in Russia, the basis of which is the principle of compulsory application of ECE Rules. After July 1997, a new edition of the system will go into effect, which in particular provides further tightening of the requirements on emissions and noise of automobiles and engines. The following order of application requirements is planned.

ECE 49

At drawing up Type Approvals:
-Until January 1, 1999 -ECE 49-02 (A) is applied;
-After January 1, 1999 -49-02 (B) is applied;

At drawing up temporary Type Approvals (not more than 1 year actual):
-Until January 1, 1998 -requirements of ECE 49-01 are applied;
-After January 1, 1998 -ECE 49-02 (A) is applied.

ECE 83

In all cases (at Type approval registration as well as for temporary Type Approval registration) the following order is applied.
Concerning automobiles equipped with compression-ignition engines:
-Until July 1, 1997 -ECE 15-04 is applied;
-After July 1, 1997-ECE 83-02 (C).

Concerning automobiles with petrol engines:
-Until January 1, 1999 -83-02 (A);
-After January 1, 1999 -83-02 (B).

ECE 51

Until July 1, 1997 -ECE 51 and national requirements;
-After July 1, 1997 -ECE 51-01 and national requirements;
-After January 1, 1999 -ECE 51-02 is applied.

25. Singapore

Singapore's vehicular emission standards for petrol-driven vehicles, motorcycles/scooters and diesel-driven vehicles are regularly reviewed and upgraded.

The approach taken in the control of vehicular emissions is through the adoption of established and internationally accepted exhaust emission standards of developed countries such as the EU and Japan. This is so because the small motor vehicle market in Singapore makes it not viable for Singapore to set her own standards.

a. Exhaust Emission Standards

Motor vehicles have to comply with the stipulated exhaust emission standards before they can be registered for use. The current exhaust emission standards for the different types of motor vehicles are as follows :

Type of Vehicle	Emission Standard (for Registration)	Implementation Date
Petrol-driven vehicles	European Union Directive 91/441/EEC (Consolidated Emissions Directive) or the JIS 78 Emission Standard	1 Jul 94
Motorcycles & Scooters	United States Code of Federal Regulations (US 40 CFR 86.410-80) Emission Standard	1 Oct 91

Vehicle Type	Emission Standard Applicable	Implementation Date
Passenger Cars	93/59/EEC	1 Jul 97
	JIS 94 Standard	1 Jul 97 till 30 Jun 98
Light Commercial Vehicles	93/59/EEC	1 Jul 97
	JIS 93 Standard	1 Jul 97 till 30 Jun 98
Heavy Duty Vehicles	91/542/EEC Stage I	1 Jul 97
	JIS 94 Standard	1 Jul 97 till 30 Jun 98

(The Japanese standards accepted for only one year to allow the motor traders more time to comply with the EC standards)

b. Automotive Fuel Quality

Automotive fuel quality plays an important part in determining the nature and quantity of pollutants emitted from motor vehicles. Cleaner fuels can significantly reduce air pollution from motor vehicles.

In an effort to bring down ambient lead levels, Singapore has, between 1980 and 1987, gradually reduced the lead content in leaded petrol from 0.84 gram per liter to the current level of 0.15 gram per liter.

Unleaded petrol was introduced in Singapore in 1991. The use of unleaded petrol is encouraged through a differential tax system making unleaded petrol about 10 cents per liter cheaper than leaded petrol. At the end of 1997, the sale of unleaded petrol constituted about 75% of the total petrol sales. Availability of unleaded petrol has enabled Singapore to adopt more stringent exhaust emission standards for petrol-driven vehicles which require the use of catalytic converters. The oil companies have voluntarily agreed to phase out leaded petrol by July 98.

Singapore has reduced the permissible sulphur content in automotive diesel from 0.5% to 0.3% by weight with effect from 1 Jul 96. There are also plans to further reduce the sulphur content to 0.05% by weight in the longer term. The move would further reduce the emission of particulate matter and sulphur dioxide from diesel vehicles, and also pave the way for the introduction of more stringent emission standards for diesel vehicles which would require the use of catalytic converters.

The current in-use vehicle emission standards and vehicle inspection frequency in Singapore are summarized below.

IN-USE VEHICLES EMISSION STANDARDS

Vehicles	Date of Registration	Standard
Petrol	Before 1 Oct 86	CO at idle 6.0% by volume
	On or after 1 Oct 86	CO at idle 4.5% by volume
	On or after 1 Jul 92	CO at idle 3.5% by volume
Diesel	All vehicles	Smoke emission 50 Hartridge Smoke Units (HSU) at free acceleration

VEHICLE INSPECTION FREQUENCY

	Frequency		
Type of Vehicles	**< 3 yrs**	**3 - 10 yrs**	**> 10 yrs**
Motorcycles	NA	Yearly	Yearly
Cars	NA	Yearly	Yearly
Taxis	6-monthly	6-monthly	NA

Type of Vehicles	< 3 yrs	3 - 10 yrs	> 10 yrs
Buses	6-monthly	6-monthly	6-monthly
Goods Vehicles	Yearly	Yearly	6-monthly

26. South Korea

Emission Standards For New Gasoline and LPG Vehicles

Vehicle Type	Date Of Implementation	Test	CO	NOx	Hydrocarbons	
					Exhaust	Evap (g/test)
Small Size Car[21]	1991 2/2	CVS-75 g/km	8	1.5	2.1	4
	1996 12/1		2.11	0.62	0.25	2
	2000 1/1		2.11	0.25	0.16	2
Passenger Car	1991 2/2	CVS-75	2.11	0.62	0.25	2
	1998 1/1		2.11	0.4	0.25	
	2000 1/1		2.11	0.25	0.16	
Light Duty Truck[22]	1991 2/2	CVS-75	6.21	1.43	0.5	2
	1998 1/1		6.21	0.75[23]	0.5	
			6.21	1.06[24]	0.5	
	2000 1/1[25]		2.75	0.25	0.24	
	2000 1/1[26]		3.11	0.43	0.29	
	2004 1/1[27]		1.27	0.16	0.18	

21/Less than 800 cc of Engine Displacement

22/GVW < 3 tons

23/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

24/All other light trucks

25/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

26/All other light trucks

27/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

Vehicle Type	Date Of Implementation	Test	CO	NOx	Hydrocarbons	
					Exhaust	Evap (g/test)
	2004 1/1[28]		1.65	0.3	0.24	
Heavy Duty Vehicle	1992 2/2	13-Mode (g/KwH)	33.5	11.4	1.3	-
	2000 1/1		33.5	5.5	1.3	
Motor Cycle (50cc-125cc)	1991 1/1	Idling (%)	5.5	-	1.1/0.45*	_
	1993 1/1		4.5	-	1.1/0.45*	
	1996 1/1		4	-	0.70/0.40*	
	2000 1/1	ECE R40 (g/km)	12.8	-	8.0/4.20*	-

* = 2 stroke/4 stroke

28/All other light trucks

Emissions Standards For New Diesel Vehicles

Vehicle Type	Date of Implementation	Test	CO	NOX	HC	PM	Smoke
Passenger Car	1991 2/2	6-Mode	980 ppm	850/450[2] (9)	670	-	50%
	1993 1/1	CVS-75 (g/km)	2.11	0.62	0.25	0.12	
	1996 1/1		2.11	0.62	0.25	0.08	
	1998 1/1		1.5	0.62	0.25	0.08	
	2000 1/1		1.2	0.62	0.25	0.05	
Light Duty Truck[30]	1991 2/2	6-Mode	980 ppm	850/450	670	-	50%
	1993 1/1	CVS-75	980	750/350	670	-	40%
	1996 1/1		6.21 g/km	1.43	0.5	0.31	
	1996 1/1 [31]		2.11	1.4	0.25	0.14	
	2000 1/1		2.11	1.02	0.25	0.11	
	2004 1/1		1.27	0.64	0.21	0.06	
Heavy Duty Vehicle	1991 2/2	6-Mode	980 ppm	850/450	670	-	50%
	1993 1/1			750/350		-	40%
	1996 1/1	13-Mode	4.9 G/kWh	11	1.2	0.9	35%
	1998 1/1			6.0 (9.0)		0.25 (0.5)	25%
	2000 1/1					0.25 (0.1)	
	2002 1/1[32]					0.15 (0.1)	

( ) city bus only

29/Direct Injection/Indirect Injection

30/GVW < 3 tons

31/GVW < 2 Tons

32/Applies to all new heavy duty engines and all city buses.

Emission Standards For In Use Vehicles

Fuel	Vehicle Type	Model Year		CO	HC	Smoke
Gasoline & LPG	Passenger Car	1987 12/31		4.5%	1200 ppm	
		1987 1/1 - 1999 12/31		1.2%	220 ppm	
		2000 1/1 -		1.2%	200 ppm	
	Small Car, Light Duty Truck, Heavy Duty Vehicle	up to 1999 12/31		4.5%	1200 ppm	
		2000	A	1.2%	220 ppm	
			B	4.5%	1200 ppm	
Diesel	Passenger Car, Light Duty Truck	up to 1995 12/31		-	-	40%
		1996 1/1 - 1997 12/31				35%
		1998 1/1				30%
	Heavy Duty Vehicle	up to 1992 12/31		-	-	40%
		1993 1/1 - 1995 12/31				35%
		1996 1/1 - 1997 12/31				30%
		1998 1/1 - 1999 12/31[33]				25%
		2000 and later				25%

A = Small Car & Light Duty Truck only
B= Heavy Duty Vehicle only

Emission Warranty Period

Fuel	Vehicle Type	Warranty Period				
		'91 2/2 - '92 12/31	'93 1/1 - '95 12/31	'96 1/1 - '97 12/31	'98 1/1 - '99 12/31	2000 1/1 -
Gasoline	Passenger Car, Small Car	5 Years or 80,000 km				
	Light Duty Truck	10,000 km	20,000 km	40,000 km	60,000 km	5 Years or 80,000 km

33/City buses only

Fuel	Vehicle Type	Warranty Period				
GAS	Passenger Car	80,000 km	100,000 km	120,000 km		
	Small Car, Light Duty Truck	10,000 km	20,000 km	40,000 km	60,000 km	5 Years or 80,000 km
Diesel	Passenger Car	-	5 Years or 80,000 km			
	Light Duty Truck	-	-	-	60,000 km	5 Years or 80,000 km

Standards For Vehicle Fuels & Fuel Additives

Fuel	Constituent	1/1/96 - 3/31/98	4/1/98 - 12/31/99	After 1/1/2000
Gasoline	Aromatics (%)	50	45	35
	Benzene (%)	5	4	2
	Lead (g/l)	0.013		
	Phosphorus (g/l)	0.0013		
	Oxygen (Wt.%)	Min 0.75	Min 1.0	1.3~2.3
	Vapor Pressure	-	-	Max 82
Diesel	Sulphur (ppm)	1000	500	200
	90% Dist. Temp (C)	-	-	Max 175

27. Taiwan

The emission standard for third stage of automobiles, third stage of motorcycles, and second stage of diesel vehicles go into effect on January 1, 1999, January 1, 1998, and July 1, 1999 respectively. And the corresponding regulatory controls will be enhanced.

Vehicle		Effective Date	CO (g/km)	HC (g/km)	NOX (g/km)	PM (g/km)
Gasoline Passenger Vehicles	GVW<3.5t	1/7/90 1/1/99	2.11 2.11	0.255 0.255	0.62 0.25	-
Gasoline Goods Vehicles & Buses	< 1200 cc	34705	11.18	1.06	1.43	-
	< 1200 cc	35801	6.2	0.5	1.43	-
	> 1200 cc	34705	6.2	0.5	1.43	-
	> 1200 cc	36166	3.11	0.242	0.68	-
Light Duty Diesel	GVW<2.5t	33975	6.2	0.5	1.43	0.38
		35801	2.125	0.156	0.25	0.05
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr
Heavy Duty Diesel	GVW> 3.5t	1991	10	1.3	6	0.7

Motorcycles

Year	Test	Durability (Km)	CO (gm/km)	HC+NOx (g/km)
1984	ECE R40	-	8.8	6.5
1991	ECE R40	6000	4.5	3
1998	ECE R40	20000	3.5	2

< In order to encourage the removal of aged buses, since September 30, 1995, more than 1200 aged buses have been removed with each receiving a stipend between $100,000 and $500,000.

< Remote sensing inspectors are situated along the streets for measuring vehicles' CO and HC emissions. Those failing the inspection are required to obtain rechecks at municipal Environmental Protection Bureaus. More than 100,000 have been inspected since 1995.

Results have indicated that taxis and first stage vehicles have higher emission rates which requires further studies and treatment.

< By the year 2001, an estimated 400,000 tests per year will be carried out by remote sensing in Taipei and 300,000 in Kaohsiung representing 61% and 88% of vehicles in the two respective metropolitan areas.

< The EPA encourages the use of LPG vehicles which will ultimately reduce pollution emission and ameliorate air quality. For every LPG vehicles purchased, a stipend will be given varying between $20,000 and $50,000. Furthermore, each establishment of LPG station will receive NT$3 million for subsidy. Since December of 1995, 10,000 LPG vehicles have been put in operation. And 3,268 taxis in the Taipei metropolitan and 2,102 taxis in the Kaohsiung metropolitan have also been replaced with LPG vehicles.

< CNG possesses higher fuel quality than that of LPG, which can be used on diesel engine buses. The city of Taipei will be subsidized with the purchase of six CNG buses; corresponding gas stations will be established prior to the end of the year. By the year 2001, it is estimated that 4,110 buses, 25% of the total number, will be modified to operate with CNG fuel. This will effectively reduce the emission of particulate matters, oxides of nitrogen, and carbon monoxide.

< Subsidies will be provided for 150 buses in the city of Taipei to install retrofit systems to ameliorate their pollution. The criterion to determine the effectiveness of each retrofit product was based in the 1st stage solely on the positive smoke removal rate. In the 2nd, stage, the adjustable parts are locked and the minimum durability mileage is 10,000 km. However, some vehicles have accumulated mileage up to 30,000 km. Five devices found to be effective products in the 1st stage and five new products are being evaluated in the 2nd stage.

< The lead-content in leaded gasoline has been gradually reduced to 0.12 g/l in 1988 then to 0.08 g/l on July 1, 1993 and to 0.026% by July 1, 1997. By the year 2000, Taiwan intends to completely phase out lead-content in gasoline. At the same time, the usage rate of unleaded gasoline has risen to 80% in 1996. And the sulfur-content in diesel oil has also been lowered form 1% to 0.5% on July 1, 1990 and to 0.3% on July 1, 1993 and 0.15% by July 1, 1997. It is planned to reduce it to 0.05% by July 1, 1998.

< Since 1992, electric motorcycles have been available in the market but sales have been modest.

< Since 1991, all new motorcycles must be equipped with evaporative controls.

< In order to reduce the pollution from in-use motorcycles, the EPA is actively promoting a motorcycle Inspection and Maintenance (I/M) system. In the first phase, from February through May, 1993, the EPA tested approximately 113,000 motorcycles in Taipei City. Of these, 49% were given a blue card indicating that they were clean, 21% a yellow card indicating that their emissions were marginal, and 30% were failed.

< Between December 1993 and May 1994, approximately 142,000 motorcycles were inspected with 55% receiving blue cards, up 6% from the earlier program, and 27% failed, a drop of 3%. The major repair for failing motorcycles was replacement of the air filter at an average cost of $20.

< Currently, there are a total of 456 stations, which include 434 stationary stations and 22 mobile stations spreading over 15 cities and/or counties. Approximately 400,000 motorcycles were inspected in 1996. To further encourage and emphasize the necessity of periodical inspection and maintenance, about 1,000 tune-up shops have been recognized as free inspection stations which increased the number of vehicles been inspected to nearly 1,530,000; a total increase rate of 80% as compared to 1995. Moreover, vehicles not yet inspected are pulled over and advised of the significance of periodical inspection, a total of 1,300,000 vehicles have been advised.

< Only 19.5% of gasoline sales at present contain lead; by 1999, lead will be banned completely.

< The development of an in use vehicle Recall system is underway. In an initial test program focused on 10 high volume engine families, two were found to have problems. On one vehicle type, extensive exhaust pipe corrosion was found; on another, a defect in the CPU chip was noted.

a. Electric Motorcycles Targeted as Key Industry for Development

Vice Premier Chao-Shiuan Liu has urged the development of electric motorcycle manufacturing capability in Taiwan. To formulate a strategy for developing this industry, Liu instructed the EPA to put together an action plan and to discuss it with other relevant agencies.

In its *Electric Motorcycle Development Action Plan*, the EPA developed objectives that are based on both environmental protection and economic considerations.

Current trends indicate that by 2010 annual sales of motorcycles will reach 9 million units. It is estimated that electric motorcycles will make up one-third of this total, or three million units sold. If this sales rate is achieved, the EPA has calculated that carbon monoxide (CO) emissions can be reduced by 42,000 metric tons annually, hydrocarbon and nitrogen oxide (NO_X) emissions by 23,400 tons, and carbon dioxide (CO_2) by 62,800 tons. As for energy savings, each year 2.2 million megawatt hours can be saved and off-peak electricity use rates can be raised.

In addition, electric motorcycles will become a major form of transportation in the next century. Based on the current market strength of Taiwan's motorcycle industry, and with the help of government support, Taiwan's annual sales of electric motorcycles should reach NT$50 billion. Moreover, Taiwan should become a global research and development center for electric motorcycles.

There are still several difficulties surrounding electric motorcycle technology and use, however.

Batteries, electric motor controllers, battery level indicators, motors, etc. are all technical areas where breakthroughs have yet to be achieved. The EPA has indicated its intention to coordinate with the Ministry of Economic Affairs (MOEA) and the National Science Council (NSC) in providing funds for research and development. The EPA and the Ministry of Transportation and Communications will be responsible for creating an environment beneficial to electric motorcycle use.

In the realm of regulatory controls, the EPA will continue to tighten emissions standards as a means to phase out highly polluting motorcycles, and thereby greatly raise the sales potential of electric motorcycles. Once the development of electric motorcycles has fully matured, the EPA will coordinate with traffic control agencies in urban areas to stop issuing registrations for motorcycles with internal combustion engines. This approach has already received the support of the Chief of the Taipei City Department of Transportation.

To lend further support, the EPA will subsidize both vehicles and batteries. Sales of electric motorcycles will be subsidized with an additional NT$3,000 per vehicle, and the EPA will provide financial support to the 2,000 electric motorcycle points of sale for the installation of battery recharging equipment.

The EPA has also indicated that total government financial support needed to implement the *Electric Motorcycle Development Action Plan* will be approximately NT$3.8 billion from fiscal years 1999 to 2002. From the Air Pollution Control Fund, NT$1.3 billion in research and development support will be needed. In addition, the MOEA and NSC will also be asked to earmark portions of their budgets for this endeavor.

Schedule	Number of vehicles to be sold	Notes
1999	10,000	EPA to select specially designated locations for initial promotion. The Kwang Yang Motor Co. (Kymco) plans to begin mass production in March, 1999.
2000	40,000	Electric motorcycle sales to comprise 2% of all motorcycle sales. EPA to implement stricter emissions standards and thus urge reduction sales of highly polluting two-stroke motorcycles.
2001	80,000	Electric motorcycle operating environment to be gradually put in place; sales to increase.
2002	150,000	50% of two-stroke motorcycle sales to be replaced by electric motorcycle sales; four-stroke motorcycles will absorb the other half.

2003	200,000	Electric motorcycle technology to become mature; production of nickel metal hydride batteries to begin. Emissions standards to be tightened further; the price of four-stroke motorcycles to exceed that of electric motorcycle
2006	400,000	Continued growth of electric motorcycle sales; annual sales of electric motorcycles to reach 40% of total motorcycle sales.

b. EPA Adopts Tougher Motorcycle Emission Standards

Following numerous discussions with industry, the EPA completed a draft of the *Motorcycle Emission Control Standards*. In addition to tightening emission limits, these standards regulate two- and four-stroke motorcycle models separately and require cold-engine emissions testing. The new standards will tighten limits on carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides ($_{NOX}$) by as much as 80%. (see table).

Current and Proposed Emission Limits for Motorcycles[1]				
Engine testing condition	Pollutant	Current (3rd Stage)	Dec. 31,'03	Dec. 31, '03
		2-, 4-stroke (warm test)	2-stroke (cold test)	4-stroke (cold test)
Driving cycle test	CO (g/km)	3.5	7.0	7.0
	HC + $_{NOX}$ (g/km)	2	1	2
Idle test	CO (%)	4.0	3.0	3.0
	HC (ppm)	6,000	2,000	2,000
In-use test	CO (%)	4.5	3.5[2]	3.5[2]
	HC (ppm)	9,000	2,000[2]	2,000[2]

Note: Average cold engine tested values of CO and HC + NOX were 2.5 times those of warm engine tested values.
[1]Includes scooters and mopeds.
[2]Limits for warm-engine test conditions.

The EPA announced on August 5 that these standards are to go into effect on December 31, 2003. Firms closely watching the development of the fourth stage standards dubbed them the

"terminating" articles for two-stroke motorcycles. The following is a list of the main features of the fourth stage standards:

1. Sets different emission standards for two- and four-stroke motorcycles. First, second and third stage standards used the same standards for both two- and four-stroke motorcycles. According to investigation results, however, the average emissions value of a cold engine tested two-stroke motorcycle was about triple that of a four-stroke motorcycle and the results were even worse when the motorcycle was in poor condition. For this reason, the standards for two-stroke motorcycles in the fourth stage standards are twice as strict as that for four-stroke motorcycles.

2. Changes tests from warm to cold engine. First, second and third stage standards testing procedures all used the warm engine method whereby tests were conducted after the motorcycle was driven for 10 kilometers until the engine was warm. According to the EPA, investigations indicated that about 70% of trips averaged less than 10 kilometers round trip with a one-way journey of no more than five kilometers. Moreover, the actual quantity of emissions detected in a cold engine test was 2.5 times that for a warm engine test.

3. Tightens emission standards for in-use motorcycles. For the sake of convenience, standards for CO and HC used to audit in-use motorcycles remained for many years at an average of 4.5% and 9,000 ppm respectively. Given the increased performance of motorcycles and to ensure that catalytic converters continue to be used, the standards for CO and HC are to be tightened to 3.5% and 2,000 ppm respectively. In the future, in-use motorcycles that are not properly maintained may have trouble passing inspection.

Two-stroke models currently account for about half of all motorcycles. Under current conditions, two-stroke models will likely have trouble adjusting to the fourth stage standards when they go into effect and thus two-stroke motorcycles are likely to be eliminated.

In terms of emissions from moving motorcycles, rough estimates indicate that two- and four-stroke emissions improvement rates for CO are to average 20% and HC + NOX are to be 80% and 60% respectively. Assuming each motorcycle ride averages 10 km round trip and 300 rides per year, annual emission reductions of CO and HC + $_{NOX}$ would be 6,000 and 10,000 metric tons respectively.

For idling motorcycles, improvement rates for CO and HC + $_{NOX}$ are to be 25% and 67% respectively which should reduce the concentration of waste gasses appreciably during traffic hours and at major intersections in urban areas.

28. Thailand

New Vehicle Standards

Vehicle Type	Level	Reference Standards	Implementation Date
Light Duty Gasoline Vehicles	1	ECE R 15-04	-
	2	ECE R83-B	34787
	3	ECE R83-01 (B)	35147
	4	93/59 EEC	35430
	5	94/12 EC	36160
	6	96/69 EC	1 Oct. 1999 RM<=1,250kg 1 Oct. 2000 RM>1,250kg
Light Duty Diesel Vehicles	1	ECE R 83-C	34727
	2	ECE R 83-01 (C)	35117
	3	93/59/EEC	35430
	4	94/12/EC	1 January 1999 30 Sept. 2001 for DI
	5	96/69/EC	1 Oct. 1999 RM<=1,250kg 1 Oct. 2000 RM>1,250kg 30 Sept. 2001 for DI
Heavy Duty Diesel Vehicles	1	ECE R 49-01	-
	2	Euro 1	12 Mar 1998
	3	Euro 2	36160
Motorcycles	1	ECE R 40-00	34190
	2	ECE R 40-01	34772
	3	CO<= 13g/km HC<=5g/km	1 July 1995 <=110 cc 1 July 1996 <=125 cc 1 July 1997 all

Vehicle Type	Level	Reference Standards	Implementation Date
	4	CO<=4.5 g/km HC+NOx<= 3g/km White Smoke<=15% Evap 2g/t (over 150 cc)	1 July 1999 <=110 cc 1 July 2000 <=125 cc 1 July 2001 all
	5	CO<=3.5 g/km HC+NOx<= 2g/km	Under Consideration

Emissions Standards For In Use Vehicles (After 1/1/1998)

Pollutant	Type of Vehicle	Standard	Device	Test Procedure
Black Smoke	Diesel	50%	Filter	Snap Acceleration
		45%	Opacity	
		40%	Filter	Full Load
		35%	Opacity	
CO	Gasoline Vehicle Registered before Nov. 1, 1993	4.5%	NDIR	Idle Test
	Gasoline Vehicle Registered after Nov. 1, 1993	1.5%		
	Motorcycle	4.5%		
HC	Gasoline Vehicle Registered before Nov. 1, 1993	600 ppm		
	Gasoline Vehicle Registered after Nov. 1, 1993	200 ppm		
	Motorcycle	10,000 ppm		

Fuels

Fuel Characteristic	Standard (Maximum)	Implementation Date
Gasoline Lead (g/l)	0.84	-
	0.45	1984
	0.4	1990
	0.15	1992
Unleaded Premium	-	1991

Fuel Characteristic	Standard (Maximum)	Implementation Date
Unleaded Regular	-	1993
Leaded Regular Phase Out	-	1994
Leaded Premium Phase Out	-	35064
Benzene	5%	33419
	3.5%	33603
Aromatics	50%	34334
	35%	36525
Diesel Sulfur	1%	pre Sept 1993
	0.5%	September 1993
	0.25%	35064
	0.05%	January 1, 1999*

* = City buses by 1/1/1997

Other measurers directed toward reducing vehicle emissions include:

< reduction of the 90% distillation temperature of diesel fuel from 370 degrees C to 357 degrees as of April 1992 in the Bangkok Metropolitan Area and after September 1992 throughout the whole country.

< Taxis and Tuk-Tuks were converted to operate on LPG.