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California's Low Emissions Vehicle Program

Compared to US EPA's Tier 2 Program

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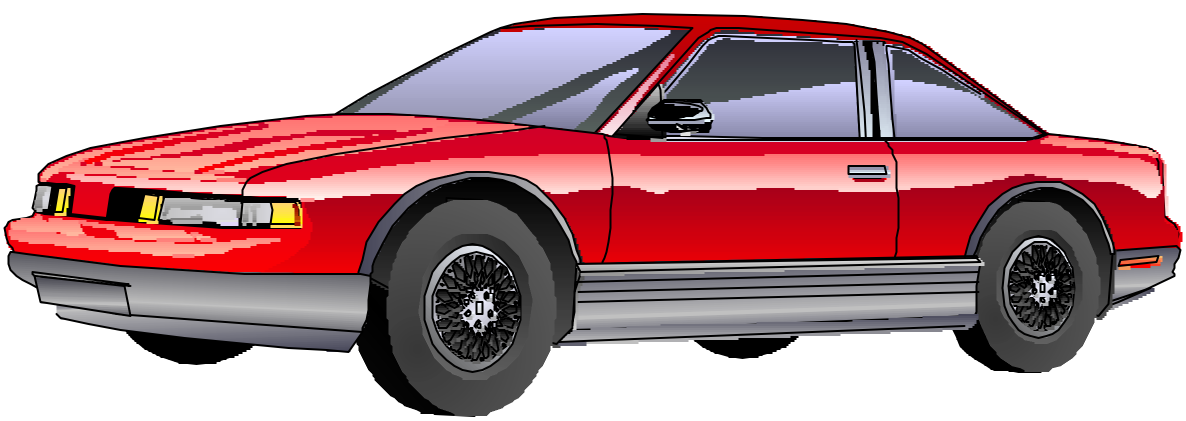

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1. Background and Introduction

Over the past year, first California and then the Federal government substantially tightened emissions standards for passenger vehicles. Clearly there has been an effort to both harmonize the two programs as much as possible and to redress loopholes which have traditionally existed while simultaneously taking full advantage of technological advances that have occurred in recent years. The major improvement in both programs has been the adoption of the principle that vehicles doing the same job, carrying passengers, must meet the same emissions standards regardless of the size of the vehicle, or the fuel used.

However, in spite of significant areas of convergence between both programs, differences remain, especially with regard to advanced vehicle technology. States such as Texas which are contemplating whether to remain with the Federal program or to adopt the California program need to understand the similarities and the differences. The purpose of this document is to summarize the key elements of each program and to highlight the pluses and minuses of each relative to the other.

2. The California Low Emissions Vehicle Program

In September 1990, as the US Congress was in the late stages of debating what eventually became the 1990 Clean Air Act Amendments, California adopted the Low Emissions Vehicle (LEV) program. The centerpiece of the program is a declining fleet average for non methane organic gas (NMOG). Four new sets of individual vehicle tailpipe standards or bins were created and manufacturers were given the flexibility to produce vehicles meeting any set of standards as well as meeting Federal standards so long as their sales weighted average complied with the declining NMOG average. The four new bins that were created were named Transitional Low Emissions Vehicles (TLEV), Low Emissions Vehicles (LEV), Ultra Low Emissions Vehicles (ULEV) and Zero Emissions Vehicles (ZEV); standards for these bins are summarized below. Beyond complying with the fleet average requirement, manufacturers were required to produce at least 2 percent ZEVs in 1998, rising to 10% by 2003

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

	NMOG*	CO	NOx
Federal Tier 1	**0.25**	**3.4**	**0.4**
TLEV	**0.125**	**3.4**	**0.4**
LEV	**0.075**	**3.4**	**0.2**
ULEV	**0.040**	**1.7**	**0.2**
ZEV	**0**	**0**	**0**

* 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.

On November 5th, 1998 the California Air Resources Board (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 and ULEV categories and the creation of a new Super Low Emissions Vehicle (SULEV) category, which would be phased in from the 2004 to 2007 model years; the changes include a more stringent NOx standard for passenger cars and light-duty trucks certified to the LEV and ULEV standards (0.05 g/mi from the current 0.2 g/mi level) and a new SULEV NOx standard less than ½ of ULEV II, 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. Manufacturer also would have the option of earning greater NMOG credits by certifying any LEV, ULEV or SULEV to a 150,000 mile certification standard and providing 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

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;

a. Current and Revised Vehicle Classes

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)[1] (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

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1/ 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.

categories can also happen between MDV2 and MDV3.

Under the LEV II program, the light-duty truck category was restructured so that trucks between 3751 lbs. LVW and 8,500 lbs. GVW are combined in a new LDT2 truck category; the lightest weight category, 0-3750 lbs. LVW would remain the same because the ZEV requirement only affects this truck class; and trucks over 8,500 lbs. GVW would remain in the medium-duty vehicle category. The new LDT2 light-duty truck category would affect the current light-duty truck 3751-5750 lb. LVW classification and all trucks currently classified as medium-duty vehicles under 8,500 lbs. GVW.

In recognition that some of the heavier trucks in the new truck category will be engineered for more rigorous duty, however, a small percentage (up to 4%) of a manufacturer's truck sales in the new LDT2 category are allowed to certify to a marginally higher NOx emission standard than the other vehicles in this class. The only other stipulation for using this allowance is that the vehicles must have a maximum base payload rating (GVW minus base curb weight) of 2500 lbs. or higher. The emission impact is expected to be minimal because of the small number of vehicles affected and because the proposed standard of 0.07 g/mi NOx at 50,000 miles is only slightly higher than the 0.05 g/mi NOx LEV emission level for most of the vehicles in this class. The 120,000 mile standard would be 0.10 g/mi NOx.

Figure 1 (attached) illustrates the overlap in these vehicle categories under the current LEV I program. This figure also includes the LEV II vehicle classes.

b. New Vehicle Standards

The following standards represent the maximum exhaust emissions for the intermediate and full useful life from new 2001 through 2003 model-year Tier 1 passenger cars, light-duty trucks and medium-duty vehicles, and from new 2001 through 2003 model year "LEV I" TLEV passenger cars and light-duty trucks, 2001 through 2006 model year "LEV I" LEVs and ULEVs in the light- and medium-duty vehicle classes and 2001 through 2006 model year "LEV I" SULEVs in the medium-duty vehicle classes, including bi-fuel, fuel-flexible and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use:

Exhaust Mass Emission Standards for New 2001 - 2003 Model Year Tier 1 Vehicles and TLEV Passenger Cars and Light-Duty Trucks; 2001 - 2006 Model Year LEV I LEV and ULEV Passenger Cars and Light-Duty Trucks; 2001-2003 Model Year Tier 1 Medium-Duty Vehicles; and 2001-2006 Model Year LEV I 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)	Particulate from diesel vehicles** (g/mi)
All PCs; LDTs (0-3750 lbs. LVW)	50,000	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	0.040	1.7	0.2	8	n/a
	100,000	Tier 1	0.31	4.2	0.6	n/a	n/a
		Tier 1 - diesel option	0.31	4.2	1.0	n/a	n/a
		TLEV	0.156	4.2	0.6	18	0.08
		LEV	0.090	4.2	0.3	18	0.08
		ULEV	0.055	2.1	0.3	11	0.04
LDTs (3751-5750 lbs. LVW)	50,000	Tier 1	0.32	4.4	0.7	n/a	0.08
		TLEV	0.160	4.4	0.7	18	n/a
		LEV	0.100	4.4	0.4	18	n/a
		ULEV	0.050	2.2	0.4	9	n/a
	100,000	Tier 1	0.40	5.5	0.97	n/a	n/a
		TLEV	0.200	5.5	0.9	23	0.10
		LEV	0.130	5.5	0.5	23	0.10
		ULEV	0.070	2.8	0.5	13	0.05
MDVs (3751-5750 lbs. ALVW)	50,000	Tier 1	0.32	4.4	0.7	18	n/a
		LEV	0.160	4.4	0.4	18	n/a
		ULEV	0.100	4.4	0.4	9	n/a
		SULEV	0.050	2.2	0.2	4	n/a
	120,000	Tier 1	0.46	6.4	0.98	n/a	0.10
		LEV	0.230	6.4	0.6	27	0.10
		ULEV	0.143	6.4	0.6	13	0.05
		SULEV	0.072	3.2	0.3	13	0.05

Vehicle Type	Durability Vehicle Basis (mi.)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulate from diesel vehicles** (g/mi)
MDVs (5751-8500 lbs. ALVW)	50,000	Tier 1	0.39	5.0	1.1	22	n/a
		LEV	0.195	5.0	0.6	22	n/a
		ULEV	0.117	5.0	0.6	11	n/a
		SULEV	0.059	2.5	0.3	6	n/a
	120,000	Tier 1	0.56	7.3	1.53	n/a	0.12
		LEV	0.280	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
MDVs 8501 -10,000 lbs. ALVW	50,000	Tier 1	0.46	5.5	1.3	28	n/a
		LEV	0.230	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
	120,000	Tier 1	0.66	8.1	1.81	n/a	0.12
		LEV	0.330	8.1	1.0	40	0.12
		ULEV	0.197	8.1	1.0	21	0.06
		SULEV	0.100	4.1	0.5	10	0.06
MDVs 10,001-14,000 lbs. ALVW	50,000	Tier 1	0.60	7.0	2.0	36	n/a
		LEV	0.300	7.0	1.0	36	n/a
		ULEV	0.180	7.0	1.0	18	n/a
		SULEV	0.09	3.5	0.5	9	n/a
	120,000	Tier 1	0.86	10.3	2.77	n/a	n/a
		LEV	0.430	10.3	1.5	52	0.12
		ULEV	0.197	10.3	1.5	26	0.06
		SULEV	0.130	5.2	0.7	13	0.06

* For Tier 1 vehicles, NMOG shall mean NMHC.

** 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 all other passenger cars and light-duty trucks and on a 120,000 mile basis for medium-duty vehicles.

The following LEV II standards represent the maximum exhaust emissions for the intermediate and full useful life from new 2004 and subsequent model-year LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use. Prior to the 2004 model year, a manufacturer that produces vehicles meeting these standards has the option of certifying the vehicles to the standards, in which case the vehicles will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

LEV II Exhaust Mass Emission Standards for New 2004 and Subsequent Model LEVs, ULEVs, and SULEVs in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulate from Diesel Vehicles (g/mi)
All PCs; LDTs <8,500 lbs. GVW Vehicles in this category are tested at their loaded vehicle weight.	50,000	LEV	0.075	3.4	0.05	15	n/a
		LEV, Option 1	0.075	3.4	0.07	15	n/a
		ULEV	0.040	1.7	0.05	8	n/a
	120,000	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
	150,000 (optional)	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulate from Diesel Vehicles (g/mi)
MDVs 8,500 - 10,000 lbs. GVW Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
	150,000 (Optional)	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
MDVs 10,001-14,000 lbs. GVW Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.230	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
	150,000 (Optional)	LEV	0.230	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

After the 2003 model year, Tier 1 standards (0.25 grams per mile NMHC) and TLEV standards would be eliminated as available emissions categories.

c. 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:

FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES (50,000 mile Durability Vehicle Basis)	
Model Year	Fleet Average NMOG (g/mi)

	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 5750 lbs. LVW
1994	0.250	0.320
1995	0.231	0.295
1996	0.225	0.287
1997	0.202	0.260
1998	0.157	0.205
1999	0.113	0.150
2000	0.073	0.099
2001	0.070	0.098
2002	0.068	0.095
2003	0.062	0.093
Model Year	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVW**
2004	0.053	0.085
2005	0.049	0.076
2006	0.046	0.062
2007	0.043	0.055
2008	0.040	0.050
2009	0.038	0.047
2010+	0.035	0.043

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 a longer phase-in period for ULEVs and SULEVs. This would give manufacturers more time to adapt their most capable passenger car emission control technology to trucks in the new category that must achieve greater emission reductions because their emission levels are currently much higher than passenger cars. In addition, the truck

fleet average is higher because it does not include a ZEV requirement (the passenger car fleet average requirement includes zero-emission vehicles, which automatically lowers a manufacturer's fleet average because they are counted as zero in the fleet average equation.)

Each manufacturer's fleet average NMOG value for the total number of PCs and LDTs produced and delivered for sale in California shall be calculated as follows:

$$\frac{3\ [\text{Number of vehicles in a test group} \times \text{applicable emission standard}] + 3\ [\text{Number of hybrid electric vehicles in a test group} \times \text{HEV NMOG factor}]}{\text{Total Number of Vehicles Produced, Including ZEVs and HEVs}}$$

The applicable emission standards to be used in the above equation are as follows:

Model Year	Emission Category	Emission Standard Value	
		All PCs; LDTs 0-3750 lbs. LVW	**LDTs 3751-5750 lbs. LVW**
2001 - 2003	Tier 1	0.25	0.32
2001 - 2006 model year vehicles certified to the "LEV I" standards (For TLEVs, 2001 - 2003 model years only)	TLEVs	0.125	0.160
	LEVs	0.075	0.100
	ULEVs	0.040	0.050
Model Year	**Emission Category**	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVW**
2001 and subsequent model year vehicles certified to the "LEV II" standards	LEVs	0.075	0.075
	ULEVs	0.040	0.040
	SULEVs	0.01	0.01
2001 and subsequent model year vehicles certified to the optional 150,000 mile "LEV II" standards for PCs and LDTs	LEVs	0.06	0.06
	ULEVs	0.03	0.03
	SULEVs	0.0085	0.0085

The HEV NMOG factor for light-duty vehicles is calculated as follows:

$$\text{LEV HEV Contribution Factor} = 0.075 - [(\text{Zero-emission VMT Factor}) \times 0.035]$$

ULEV HEV Contribution Factor = 0.040 - [(Zero-emission VMT Factor) x 0.030]

Although manufacturers can choose their own implementation schedule, the following is a possible phase-in scenario that CARB staff judged to be feasible in the 1994-2003 time frame (and was used to develop the fleet average values)

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

MODEL YEAR	Tier 0 0.39	Tier 1 0.25	TLEV 0.125	LEV 0.075	ULEV 0.040	ZEV* 0.00	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.

The following is a possible phase-in scenario that CARB staff judged to be feasible in the 2004-2010 time frame (and was used to develop the fleet average values).

One Possible Percentage Implementation Schedule for PCs and LDT1s

Model Year	TLEV	LEV	ULEV	SULEV	ZEV
2004	2	48	35	5	10
2005	2	40	38	10	10
2006	2	35	41	12	10
2007	1	30	44	15	10
2008	1	25	44	20	10
2009	1	20	49	20	10
2010	1	15	49	25	10

One Possible Percentage Implementation Schedule for LDT2s

Model Year	TLEV	LEV	ULEV	SULEV	ZEV
2004	19	81	0	0	0
2005	16	63	21	0	0
2006	8	48	38	6	0
2007	2	43	50	5	0
2008	1	35	54	10	0
2009	1	25	64	10	0
2010	1	20	64	15	0

As noted earlier, however, the TLEV category was eliminated by the full Board after 2003, so manufacturers will need to shift toward slightly more LEVs and ULEVs to comply.

LEV II Phase-In Requirement. In addition to complying with the NMOG fleet average and the ZEV mandate, beginning in the 2004 model year, a manufacturer shall certify a percentage of its PC and LDT fleet to the LEV II standards according to the following phase in schedule:

Model Year	PC/LDT1 (%)	LDT2 (%)
2004	25	25
2005	50	50
2006	75	75
2007	100	100

In determining compliance with the phase-in schedule, the fleet shall consist of LEV I and LEV II PCs and LDT1s for the PC/LDT1 calculation, and LEV I and LEV II LDT2s for the LDT2 calculation. LEV I MDVs are not counted in the calculation until they are certified as LEV II LDT2s.

A manufacturer may use an alternative phase-in schedule to comply with these phase-in requirements as long as equivalent NOx emission reductions are achieved by the 2007 model year from each of the two categories -- PC/LDT1 or LDT2. Model year emission reductions shall be calculated by multiplying the percent of either PC/LDT1 or LDT2 vehicles meeting the LEV II standards in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2004 model year, 3 for the 2005 model year, 2 for the 2006 model year and 1 for the 2007 model year. The yearly results for PCs/LDT1s shall be summed together to determine a separate cumulative total for PCs/LDT1s and the yearly results for LDT2s shall be summed together to determine a cumulative total for LDT2s. The cumulative total for each category must be equal to or exceed 500 to be considered equivalent. A manufacturer may add vehicles introduced before the 2004 model year (e.g., the percent of vehicles introduced in 2003 would be multiplied by 5) to the cumulative total.

d. The ZEV Mandate: Partial ZEV Credits

A unique aspect of the California program, as noted earlier, is the ZEV mandate. In 1996, the ZEV mandate was amended to require major car makers to produce for sale between 1,250 and 3,750 advanced battery electric vehicles between 1998 and 2000; the 10 percent mandate was left unchanged. The LEV II rule modifies the 2003 10 percent mandate in two ways. It gives multiple credits for ZEVs with all-electric range over 100 miles, and it allows a hybrid-electric, fuel cell, and gasoline or natural gas powered vehicles that meet the SULEV standard to receive partial ZEV credits for up to 6 percent of the 10 percent mandate. (Only the largest seven manufacturers with sales over 35,000 vehicles per year in California are required to sell a minimum of 4% ZEVs; the next six largest manufacturers can comply through sales of partial ZEVs.)

The table below 'Multiple ZEV Credits' shows the relatively high number of credits for EVs starting in MY 1999 and extending until 2007. The effect is to further lessen the number of EVs on the road in 2003 and thereafter. Most EVs - - the GM EV1 with NiMH batteries, the Toyota RAV4, the Honda EVPlus – already achieve more than a 100 miles per charge with today's battery technology.

Multiple ZEV credits

All-electric range	MY 1999-2000	2000-2002	2003-2005	2006-2007
100-175 miles	6-10	4-6	2-4	1-2

Car makers are allowed to satisfy up to six percent of their ZEV sales mandate obligation (and as noted above, some can satisfy the entire mandate) with a mixture of advanced technology, ultra-clean, non-all-electric range vehicles. A complex methodology was developed to quantify the appropriate partial ZEV credits for various technologies. The table below provides a partial list of the options.

VEHICLE/TECHNOLOGY TYPE	PARTIAL ZEV CREDIT
Gasoline SULEV (e.g., the 2000 MY Nissan Sentra)	0.2
Hybrid gasoline SULEV with no all-electric range, equipped with advanced batteries, and an electric power train (e.g., Honda Insight)	0.3
Natural gas SULEV (e.g. the 2000 MY Honda Civic NG)	0.4
Gasoline hybrid SULEVs with 20 miles all-electric range, off-vehicle range and recharging	0.6
On-board methanol reformer fuel cell vehicle	0.7

Electric vehicles are given a full credit (1.0), as are hybrid SULEVs with advanced batteries and 100 mile range, as well as hydrogen fuel cell vehicles with off-board reformers.

e. Medium Duty Vehicles

There are two types of medium-duty vehicles - those that are certified using the chassis dynamometer (the left column of the Table below) and those certified using an engine dynamometer (the right column of the Table). 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.

LEV I 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

LEV I 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

Test Weight (lbs)	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG	CO	NO_X	PM
		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

Beginning with the 2004 model year, a manufacturer shall phase-in at least one test group per model year to the MDV LEV II standards.

For the 2001 and subsequent model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturers' total production of California-certified medium-duty vehicles delivered for sale in California.

The current regulations require that manufacturers must produce 60% of their medium-duty fleet as LEVs and 40% as ULEVs by the 2004 model year. Under LEV II, the percent requirements were

amended to require 40% LEVs and 60% ULEVs beginning in the 2004 model year. These percentages would apply to medium-duty vehicles certified to either the LEV I standards or the LEV II standards depending on a manufacturer's production schedule; however, Tier 1 MDVs could no longer be certified after the 2003 model year and the LEV I medium-duty LEVs and ULEVs could no longer be certified after the 2006 model year. In addition, a manufacturer must certify at least a portion of its fleet each year to the LEV II standards.

f. Costs

The ARB staff has performed a comprehensive cost analysis of the proposed LEV II exhaust emission requirements applicable to passenger car, light-duty trucks and medium-duty vehicles. Specifically, staff estimated the incremental cost of a ULEV II compared to a ULEV I vehicle for passenger car, light-truck (3751 lb. LVW- 8500 lb. GVW), and medium-duty (8500-10,000 lb. GVW) applications and the incremental cost of a SULEV vehicle for four and six-cylinder passenger car and light-truck applications. Incremental retail costs of ULEV II and SULEV vehicles compared to a ULEV I vehicle are:

Category	ULEV II (in $)	SULEV (in $)
PC	71	131
LDT 1	46	105
LDT 2	184	279
MDV 2	208	-
MDV 3	209	-
MDV 4	134	-

g. Evaporative Emissions

Evaporative emissions from motor vehicles account for approximately half of the ROG motor vehicle emission inventory in California. These emissions are due to gasoline vapors escaping from the vehicle into the atmosphere, and are highly dependent on ambient temperatures and the characteristics of the gasoline fuel. For example, high ambient temperatures and large changes in ambient temperatures throughout the day, such as those that occur in the summer months on many ozone-nonattainment days, exacerbate the potential for high evaporative emissions.

Evaporative emissions are classified into three types: running loss, hot soak, and diurnal emissions. Running loss emissions occur when the vehicle is driven and can originate from numerous sources within the fuel system and from fuel vapor overflow of the on-board carbon canister. Hot soak emissions occur immediately after a fully-warmed up vehicle is stationary with the engine turned off and are due to high underhood temperatures. Diurnal emissions occur when a vehicle is parked and are caused by daily ambient temperature changes. Most of these emissions result during increases in ambient temperatures which cause an expansion of the vapor in the fuel tank.

i. Current Standards

Beginning with the 1995 model year, the "enhanced" evaporative standards and test procedures were implemented, requiring effective control of the three types of evaporative emissions. Two test sequences are applicable for certification: (1) the 3-day diurnal-plus-hot-soak sequence ensures that running loss emissions, high-temperature hot soak emissions, and three days of diurnal emissions are controlled, and (2) the 2-day diurnal-plus-hot-soak sequence verifies that the canister is well purged during vehicle operation. Compliance with three separate emission standards is required for the vehicle's useful life: a stand-alone running loss standard, a combined highest three-day diurnal plus high-temperature hot soak standard, and a combined highest two-day diurnal plus moderate-temperature hot soak standard. These standards are shown below.

Current Enhanced Evaporative Standards

Class of Vehicle	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)	Running Loss (grams per mile)
Passenger Cars, Light-Duty Trucks	2.0	2.5	0.05
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)			
with fuel tanks < 30 gallons	2.0	2.5	0.05
with fuel tanks$ 30 gallons	2.5	3.0	0.05
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	3.0 (1)	3.5	0.05
	2.0 (2)	3.5	0.05
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	2.0	4.5	0.05
Hybrid Electric PCS, LDTs and MDVs	2.0	2.5	0.05

(1) The standards in this row apply to complete medium-duty vehicles.
(2) The standards in this row apply to incomplete medium-duty vehicles.

ii. LEV II Standards

The reduced evaporative emission standards are shown below for the three-day diurnal-plus-hot-soak test and the two-day diurnal-plus-hot-soak test. The standards are expressed in total vehicle HC evaporative emissions and include both fuel and non-fuel vehicle emissions. As in the case of the current standards, they would be applicable to gasoline-fueled, liquefied-petroleum-gas-fueled,

and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles, including flexible-fuel vehicles, dual-fuel vehicles, hybrid-electric vehicles, and zero-emission vehicles with fuel fired heaters. The running loss standards are unchanged from the current requirements and are shown to illustrate the full set of evaporative standards for compliance purposes.

The new standards for passenger cars are significantly reduced from the current evaporative standards, almost an 80 percent reduction. The standards in the other vehicle categories are based on the proposed passenger car standards and are incrementally increased to account for higher non-fuel emissions of the larger vehicles. Data suggest that larger vehicles may have greater non-fuel evaporative emissions, likely due to an increased amount of interior trim, vehicle body surface area, and larger tires. Two sets of evaporative standards are proposed for the new light-duty truck category to account for the increased potential of higher non-fuel vehicle evaporative emissions for the larger vehicles in this category.

The three-day diurnal-plus-hot-soak standards are numerically lower than the two-day diurnal-plus-hot-soak standards to reflect that the three-day diurnal-plus-hot-soak standards are technology forcing. The main function of the two-day diurnal-plus-hot-soak standards is to ensure adequate purging of the carbon canister during vehicle operation. Compliance with the evaporative standards would require improvements to conventional evaporative/fuel systems.

Evaporative Emission Standards

Class of Vehicle	Hydrocarbon Standards		
	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)	Running Loss* (grams per mile)
Passenger Cars	0.50	0.65	0.05
Light-Duty Trucks (under 8,501 lbs. GVWR)			
under 6,000 lbs. GVWR	0.65	0.85	0.05
6,001 - 8,500 lb. GVWR	0.90	1.15	0.05
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	1.00	1.25	0.05
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	1.00	1.25	0.05

* The running loss standards shown here are unchanged from the current requirements and are shown to illustrate the full set of evaporative standards for compliance purposes.

iii. Useful-Life Requirement

The current useful-life requirements in which the vehicle must comply with the applicable evaporative

emission standards are 10 years or 100,000 miles, whichever first occurs, for passenger cars and light-duty trucks; 11 years or 120,000 miles, whichever first occurs, for medium-duty vehicles; and 8 years or 110,000 miles, whichever first occurs, for heavy-duty vehicles. The new evaporative (running loss, diurnal, and hot soak) useful-life requirement is 15 years or 150,000 miles, whichever first occurs, for all applicable vehicles.

iv. Phase-in Schedule

The phase-in schedule for the implementation of the evaporative standards is shown below. As shown, the implementation schedule is 40 percent in the 2004 model year, 80 percent in the 2005 model year, and 100 percent in the 2006 and subsequent model years.

Phase-in Implementation Schedule for the Evaporative Standards

2004 MY	2005 MY	2006 and subsequent MY
40%	80%	100%

v. Optional Zero-Fuel Evaporative Standards

Optional zero-fuel evaporative standards were also adopted that would allow a manufacturer to generate credits to meet the ZEV requirements and the NMOG fleet average requirements. The zero-fuel evaporative standards would require the elimination of fuel evaporative emissions.

vi. Cost

CARB estimates that the total incremental retail cost increase per vehicle of this provision is approximately $25 per vehicle. The detailed cost analysis is outlined below.

Incremental Costs Per Vehicle for the Evaporative Proposal

Category	**Cost**
Variable Costs	
Hardware	$20.92
Assembly	$0.25
Warranty	$0
Shipping	$.10
Fixed Costs	
Facility Upgrades	$0

Category	Cost
Basic Research	$0
Advanced Engineering Research	$1.38
Legal	$0
Administration	$0
Investment Recovery	$1.36
Total Manufacturer Cost	$24.01
Dealership Cost	$1.08
Total Retail Cost	$25.09

h. Fuels

California gasoline production is governed by both state and federal regulations. The CaRFG2 regulations were adopted by the ARB in 1991 and were implemented statewide in 1996. These regulations established a comprehensive set of specifications including limits for eight gasoline properties as shown in the Table below. The CaRFG2 regulations have provided very significant reductions of ozone and particulate matter precursor emissions and toxic air pollutants. The CaRFG regulations are also a major component of California's plan for achieving ambient air quality standards.

Basic CaRFG2 Limits and Caps

Property	Pre-CaRFG2 (summer)	Flat Limits	Averaging Limits	Cap Limits[1]
Reid vapor pressure, psi, max	7.8	7.0	---	7.0
Benzene, vol%, max	2.0	1.00	0.80	1.20
Sulfur, ppmw, max	150	40	30	80
Aromatic HC, vol%, max	32	25	22	30
Olefins, vol%, max	9.9	6.0	4.0	10
Oxygen, wt%	0	1.8 to 2.2	---	1.8 (min)[2] 3.5 (max)
T50 (temp. at 50% distilled) ^{o}F, max	220	210	200	220
T90 (temp. at 90 % distilled) ^{o}F, max	330	300	290	330

(1) The "cap limits" apply to all gasoline at any place in the marketing system and are not adjustable.
(2) The 1.8 weight percent minimum applies only during the winter and only in certain areas.

For each batch of gasoline being supplied from the refinery, the gasoline producer can comply with the regulations in one of three ways. First, for a given property, each producer may choose to meet either the flat limit or the averaging limit, as shown in the table. When choosing the flat limits, a producer may not exceed the flat limits for any gasoline sold. Whereas under the averaging limits, the volume weighted average value of individual gasoline properties can not exceed the averaging limits. The second compliance option allows producers the use of a Predictive Model to identify other sets of property limits (flat, averaging, or mixed) that may be more optimal for refiners. The Predictive Model is basically a set of equations relating gasoline properties to vehicle emissions that are used to identify alternative limits that correspond to equal or better exhaust emissions than the flat or averaging limits. The third compliance option allows for certification of alternative gasoline formulations based on the results of vehicle emission testing. Currently, most of the gasoline sold in California complies with the CaRFG regulations through the use of the Predictive Model.

Finally, cap limits are included for the various gasoline properties. These cap limits provide an upper limit for fuel properties for all compliance options and allow enforcement throughout the gasoline distribution system.

The United States Environmental Protection Agency (U.S. EPA) also has enacted federal reformulated gasoline (RFG) regulations. Nationally, about 30 percent of the gasoline produced must meet these requirements. These regulations impose emission performance standards in conjunction with specific requirements for oxygen content (year-round average of 2.0 percent by weight), and limits on benzene content. The federal requirements are being implemented in two phases. The first phase began in 1995 and the second phase begins in December 1999. For California, the federal RFG regulations were first implemented in 1995 in the South Coast and San Diego, and then in 1996 in the Sacramento Metropolitan Region. These areas of the State account for about 70 percent of the gasoline sold in California. California's own CaRFG2 regulations achieve greater emission reductions than the federal RFG program and apply statewide. The U.S. EPA, in the September 15, 1999 Federal Register, made the finding that the emission reduction benefits of California gasoline are at least as great as those from federal Phase II RFG.

Because of the 1990 federal Clean Air Act Amendments requirement that mandated the use of a minimum oxygen content (2.0 percent by weight) year-round in federal RFG areas, the use of oxygenates, and MTBE in particular, has grown significantly. MTBE has favorable characteristics as a gasoline blending component, and has become the oxygenate of choice among gasoline producers for meeting CaRFG2 and federal RFG standards.

3. The Federal Program

a. US Truck Definitions

The current US Truck definitions are summarized below.

	GVWR	Curb Wt.	Loaded Vehicle Wt.	Frontal Area
LLDT	0-6000			
LDT	0-6000	>6000		<45
LDT1			0-3750	
LDT2			3750<	
HLDT	6001-8500			
LDT3	6001-8500		0-5750	
LDT4	"		5750>	
HDV	8500>	6000>		45>

b. NLEV

Starting in the northeastern states in model year 1999 and nationally in model year 2001, new cars and light light-duty trucks will meet National Low Emission Vehicle Standards (NLEV).

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 LDT1 (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
LDT2 (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.

Therefore passenger cars and LDT1's must comply on average with California LEV standards (0.2 NOX at 50,000 miles; 0.3 NOX at 100,000 miles) with five possible bins as summarized below (100,000 mile standards unless noted):

Bin	CO	NOx	PM
Tier 1	4.2	0.6	0.08 (50k only)
TLEV	4.2	0.6	0.08
LEV	4.2	0.3	0.08
ULEV	2.1	0.3	0.04
ZEV	0	0	0

LDT2s must on average comply with the California LDT2 LEV standard (0.5 NOx at 100,000 miles) with four bins available as summarized below:

Bin	CO	NOx	PM
Tier 1	5.5	0.97	0.08 (50k only)
TLEV	5.5	0.9	.1
LEV	5.5	0.5	.1
ULEV	2.8	0.5	.05

The applicable Tier 1 standards for LDT3 and LDT4 are not affected by NLEV and are summarized below:

Vehicle Category	CO	NOx	PM
LDT3	6.6	0.98	0.10
LDT4	7.3	1.53	0.12

c. Tier 2 Rule

On December 21, 1999, the Administrator signed the Final Tier 2 Rule. Highlights include the following:

For cars, and light trucks, and larger passenger vehicles, the program will:

- Starting in 2004, through a phase-in, apply the same set of emission standards covering passenger cars, light trucks, and large SUVs and passenger vehicles.
- Introduce a new category of vehicles, “medium-duty passenger vehicles,” thus bringing larger passenger vans and SUVs into the Tier 2 program.

- During the phase-in, apply interim fleet emission average standards that match or are more stringent than current federal and California “LEV I” (Low-Emission Vehicle, Phase I) standards.
- Apply the same standards to vehicles operated on any fuel.
- Allow auto manufacturers to comply with the new standards in a flexible way while ensuring that the needed environmental benefits occur.
- Set more stringent particulate matter standards.
- Set more stringent evaporative emission standards.

For commercial gasoline, the program will:

- Significantly reduce average gasoline sulfur levels nationwide as early as 2000, fully phased in in 2006. Refiners will generally add refining equipment to remove sulfur in their refining processes. Importers of gasoline will be required to import and market only gasoline meeting the sulfur limits.
- Provide for flexible implementation by refiners through an averaging, banking, and trading program.
- Encourage early introduction of cleaner fuel into the marketplace through an early sulfur credit and allotment program.
- Apply temporary gasoline sulfur standards to certain small refiners and gasoline marketed in a limited geographic area in the western U.S.
- Enable the new Tier 2 vehicles to meet the emission standards by greatly reducing the degradation of vehicle emission control performance from sulfur in gasoline. Lower sulfur gasoline also appears to be necessary for the introduction of advanced technologies that promise higher fuel economy but are very susceptible to sulfur poisoning (for example, gasoline direct injection engines).
- Reduce emissions from NLEV vehicles and other vehicles already on the road.

i. Vehicle Requirements

The Rule sets new federal emission standards (“Tier 2 standards") for passenger cars, light trucks, and larger passenger vehicles. The program will also, for the first time, apply the same set of federal standards to all passenger cars, light trucks, and medium-duty passenger vehicles. Light trucks include “light light-duty trucks” (or LLDTs), rated at less than 6000 pounds gross vehicle weight and “heavy light-duty trucks” (or HLDTs), rated at more than 6000 pounds gross vehicle weight).[2] “Medium-duty passenger vehicles” (or MDPVs) form a new class of vehicles introduced by this rule that includes SUVs and passenger vans rated at between 8,500 and 10,000 GVWR. The program thus ensures that essentially all vehicles designed for passenger use in the future will be very clean vehicles.

The Tier 2 standards will reduce new vehicle NOx levels to an average of 0.07 grams per mile (g/mi). For new passenger cars and light LDTs, these standards will phase in beginning in 2004, with the

2/ A vehicle’s “Gross Vehicle Weight Rating,” or GVWR, is the curb weight of the vehicle plus its maximum recommended load of passengers and cargo.

standards to be fully phased in by 2007.[3] For heavy LDTs and MDPVs, the Tier 2 standards will be phased in beginning in 2008, with full compliance in 2009.

During the phase-in period from 2004-2007, all passenger cars and light LDTs not certified to the primary Tier 2 standards will have to meet an interim average standard of 0.30 g/mi NOx, equivalent to the current NLEV standards for LDVs and more stringent than NLEV for LDT2s (e.g., minivans).[4] During the period 2004-2008, heavy LDTs and MDPVs not certified to the final Tier 2 standards will phase in to an interim program with an average standard of 0.20 g/mi NOx, with those not covered by the phase-in meeting a per-vehicle standard (i.e., an emissions "cap") of 0.60 g/mi NOx (for HLDTs) and 0.9 g/mi NOx (for MDPVs).

By creating a new category of vehicles subject to the Tier 2 standards, medium-duty passenger vehicles, the final rule will ensure that all passenger vehicles expected to be on the road in the foreseeable future will be very clean.

(1) Vehicle Categories

The light-duty category of motor vehicles includes all vehicles and trucks at or below 8500 pounds gross vehicle weight rating, or GVWR (i.e., vehicle weight plus rated cargo capacity). The Table below shows the various light-duty categories and also shows the new medium-duty passenger vehicle (MDPV) category.

3/ By comparison, the NOx standards for the National Low Emission Vehicle (NLEV) program, which will be in place nationally in 2001, range from 0.30 g/mi for passenger cars to 0.50 g/mi for medium-sized light trucks (larger light trucks are not covered). For further comparison, the standards met by today's Tier 1 vehicles range from 0.60 g/mi to 1.53 g/mi.

4/ There are also NMOG standards associated with both the interim and Tier 2 standards. The NMOG standards vary depending on which of various individual sets of emission standards manufacturers choose to use in complying with the average NOx standard. This "bin" approach is described more fully in section IV.B. of this preamble.

Light-Duty Vehicles and Trucks and Medium-Duty Passenger Vehicles; 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. Includes LDT3 and LDT4s.
MDPV	A heavy-duty passenger vehicle rated at less than 10,000 lbs GVWR.

(2) Corporate Average NOx Standard

The program will ultimately require each manufacturer's average full life NOx emissions over all of its Tier 2 vehicles to meet a NOx standard of 0.07 g/mi each model year. Manufacturers will have the flexibility to certify Tier 2 vehicles to different sets of exhaust standards that are generally referred to as "bins," but will have to choose the bins so that their corporate sales weighted average full life NOx level for their Tier 2 vehicles is no more than the 0.07 g/mi. The manufacturer will be in compliance with the standard if its corporate average NOx emissions for its Tier 2 vehicles meets or falls below 0.07 g/mi. In years when a manufacturer's corporate average is below 0.07 g/mi, it can generate credits. It can trade (sell) those credits to other manufacturers or use them in years when its average exceeds the standard (i.e. when the manufacturer runs a deficit).

(3) Tier 2 Exhaust Emission Standard "Bins"

The final Tier 2 bin structure has eight emission standards bins (bins 1-8), each one a set of standards to which manufacturers can certify their vehicles. The Table below shows the full useful life standards that will apply for each bin in the final Tier 2 program, i.e. after full phase-in occurs for all LDVs and LDTs. Two additional bins, bins 9 and 10, will be available only during the interim program and will be deleted before final phase-in of the Tier 2 program. An eleventh bin is available but only for MDPVs (see below). Many bins have the same values as bins in the California LEV II program as a means to increase the economic efficiency of the transition to as well as model availability. The two highest of the ten bins shown are designed to provide flexibility only during the phase-in years and will terminate after the standards are fully phased in, leaving eight bins in place for the duration of the Tier 2 program.

Tier 2 Light-Duty Full Useful Life Exhaust Emission Standards (grams per mile)

Bin#	NOx	NMOG	CO	HCHO	PM	Comments
11	0.9	0.280	7.3	0.032	0.12	a,c
10	0.6	0.156/0.230	4.2/6.4	0.018/0.027	0.08	a,b,d
9	0.3	0.090/0.180	4.2	0.018	0.06	a,b,e
8	0.20	0.125/0.156	4.2	0.018	0.02	b,f
7	0.15	0.090	4.2	0.018	0.02	
6	0.10	0.090	4.2	0.018	0.01	
5 (LEV 2)	0.07	0.090	4.2	0.018	0.01	
4	0.04	0.070	2.1	0.011	0.01	
3	0.03	0.055	2.1	0.011	0.01	
2 (SULEV)	0.02	0.010	2.1	0.004	0.01	
1 (ZEV)	0.00	0.000	0.0	0.000	0.00	

NOTES

a. This bin and its corresponding intermediate life bin are deleted at end of 2006 model year (end of 2008 model year for HLDTs and MDPVs).
b. Higher NMOG, CO and HCHO values apply for HLDTs and MDPVs only.
c. This bin is only for MDPVs.
d. Optional NMOG standard of 0.280 g/mi applies for qualifying LDT4s and qualifying MDPVs only.
e. Optional NMOG standard of 0.130 g/mi applies for qualifying LDT2s only.
f. Higher NMOG standard deleted at end of 2008 model year.

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

Bin#	NOx	NMOG	CO	HCHO	PM	Comments
11	0.6	0.195	5.0	0.022	--	a,c,f,h
10	0.4	0.125/0.160	3.4/4.4	0.015/0.018	--	a,b,d,f,g,h
9	0.2	0.075/0.140	3.4	0.015	--	a,b,e,f,h
8	0.14	0.100/0.125	3.4	0.015	--	b,f,h,i
7	0.11	0.075	3.4	0.015	--	f,h

6	0.08	0.075	3.4	0.015	--	f,h
5	0.05	0.075	3.4	0.015	--	f,h

NOTES

a. This bin deleted at end of 2006 model year (end of 2008 model year for HLDTs and MDPVs).
b. Higher NMOG, CO and HCHO values apply for HLDTs and MDPVs only.
c. This bin is only for MDPVs.
d. Optional NMOG standard of 0.195 g/mi applies for qualifying LDT4s and qualifying MDPVs only.
e. Optional NMOG standard of 0.100 g/mi applies for qualifying LDT2s only.
f. The full useful life PM standards also apply at intermediate useful life.
g. Intermediate life standards of this bin are optional for diesels.
h. Intermediate life standards are optional for vehicles certified to a useful life of 150,000 miles.
i. Higher NMOG standard deleted at end of 2008 model year.

Any combination of vehicles meeting the 0.07 g/mi average NOx standard will have average NMOG levels below 0.09 g/mi. The actual value will vary by manufacturer depending on the sales mix of the vehicles used to meet the 0.07 g/mi average NOx standard. In addition, there will be overall improvements in NMOG since Tier 2 incorporates HLDTs, which are not covered by the NLEV program. Tier 2 also imposes tighter standards on LDT2s than the NLEV program by making them average with the LDVs and LDT1s. NLEV has separate, higher standards for LDT2s.

(4) Schedules for Implementation

The Table below provides a graphical representation of how the phase-in of the Tier 2 program will work for all vehicles.

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] [b] [b]			**25**	**50**	**75**	**100**	**100**	**100**	**0.07 avg**
HLDT (TIER 2 +evap)	***early banking*** [b] [b] [b] [b] [b] [b] [b]							**50**	**100**	**0.07[d] avg**

HLDT (INTERIM)	**TIER 1** [b]	**TIER 1** [b]	**TIER 1** [b]	**25** [c,e]	**50** [e]	**75** [e]	**100** [e]	**50 max**		**0.20**[a,d] **avg**
MDPVs (INTERIM)	**HDE**	**HDE**	**HDE**							
MDPVs (TIER 2 + evap)	***early banking*** [b]							**50**	**100**	**0.07**[d] **avg**

NOTES

a. 0.60 NOx cap applies to balance of LDT3s/LDT4s, respectively, 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..

c. Required only for manufacturers electing to use optional NMOG values for LDT2s or LDT4s and MDPV flexibilities during the applicable interim program and for vehicles whose model year commences on or after the fourth anniversary date of the signature of this rule.

d. MDPVs HLDTs and MDPVs must be averaged together.

e. Diesels may be engine-certified through the 2007 model year.

ii. Interim Standards

The interim standards discussed below are a major source of emission reductions in the early years of the vehicle control program. The NOx emission standards for LDT2s, LDT3s and LDT4s, which comprise about 40 percent of the fleet, are more stringent than the corresponding standards in the NLEV and CAL LEV I programs.

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, [5] 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 (by a factor of 14-22) relative to the 0.07 g/mi Tier 2 NOx average.

(1) Interim Exhaust Emission Standards for LDV/LLDTs.

Beginning with the 2004 model year, all new LDVs, LDT1s and LDT2s not incorporated under the Tier 2 phase-in will be subject to an interim corporate average NOx standard of 0.30 g/mi. This is effectively the LEV NOx emission standard for LDVs and LDT1s under the NLEV program.[6] This interim program will hold LDVs and LLDTs to NLEV levels if they are not yet subject to Tier 2

5/ The NLEV program imposes NMOG average standards that translate into full useful life NOx levels of about 0.3 g/mi for LDV/LDT1s and 0.5 g/mi for LDT2s.

6/ The NLEV program does not impose average NOx standards, but the NMOG average standards that it does impose will lead to full useful life NOx levels of about 0.3 g/mi for LDV/LDT1s.

standards during the phase-in. LDT2s will be held to a 0.3 g/mi NOx average in contrast to a 0.5 g/mi average in the NLEV program.

The proposal to bring LDT2s into line with the LDVs and LDT1s during the interim program by requiring all LDVs, LDT1s and LDT2s to meet the same average NOx standard (0.30) g/mi is retained, but EPA is providing an optional NMOG standard of 0.130 for LDT2s certified to bin 9 when the manufacturers of those LDT2s elect to bring all of their 2004 model year HLDTs under the interim program and phase 25% of those HLDTs into the 0.20 g/mi average NOx standard.

(2) Interim Exhaust Emission Standards for HLDTs.

The interim standards for HLDTs will begin in the 2004 model year similar to the proposal in the NPRM. The Interim Program for HLDTs will require compliance with a corporate average NOx standard of 0.20 g/mi that will be phased in between 2004 and 2007. The interim HLDT standards, will make use of the same bins as those for LDV/LLDTs shown above.

Due to statutory lead time considerations, EPA was not able to finalize the HLDT standards to be in effect by the time the 2004 model year begins. For this reason, it is providing incentives for HLDTs to comply with the Tier 2 standards for all 2004 model year HLDTs.

iii. Generating, Banking, and Trading NOx Credits

As proposed in the NPRM and finalized in the Rule, manufacturers will be permitted to average the NOx emissions of their Tier 2 vehicles and comply with a corporate average NOx standard. In addition, when a manufacturer's average NOx emissions fall below the corporate average NOx standard, it can generate NOx credits for later use (banking) or to sell to another manufacturer (trading). NOx credits will be available under the Tier 2 standards, the interim standards for LDVs and LLDTs, and the interim standards for HLDTs.

Banking and trading of NOx credits under the interim non-Tier 2 standards will be similar to that under the Tier 2 standards, except that a manufacturer must 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. As proposed in the NPRM, interim credits from LDVs/LLDTs and interim credits from HLDTs will not be permitted to be used interchangeably due to the differences in the interim corporate average NOx standards. As proposed in the NPRM, there will be no provisions for early banking under the interim standards and manufacturers will not be allowed to use interim credits to address the Tier 2 NOx average standard.

EPA is finalizing provisions to permit manufacturers, at the beginning of the program, to weight LDV/Ts certified to the lowest two bins more heavily when calculating their fleet average NOx emissions. Under this provision, which applies through the 2005 model year, manufacturers may apply a multiplier to the number of LDV/Ts sold that are certified to bins 1 and 2 (ZEVs and SULEVs in California terms). This adjusted number will be used in the calculation of fleet average NOx emissions for a given model year and will allow manufacturers having vehicles certified to these bins to generate additional credits (or use fewer credits) that year.

The multipliers that manufacturers may use are found in the Table below

Multipliers for Additional Credits for Bin 1 and 2 LDV/Ts

Bin	Model Year	Multiplier
2	2001, 2002, 2003, 2004, 2005	1.5
1	2001, 2002, 2003, 2004, 2005	2.0

iv. Light-Duty Evaporative Emission Standards

More stringent evaporative emission standards are adopted for all Tier 2 light-duty vehicles and light-duty trucks. The standards are shown in the Table below and represent, for most vehicles, more than a 50% reduction in diurnal plus hot soak standards from those that will be in effect in the years immediately preceding Tier 2 implementation. The higher standards for HLDTs provide allowance for greater non-fuel emissions related to larger vehicle size.

Final Evaporative Emission Standards
(grams per test)

VEHICLE CLASS	3 DAY DIURNAL +HOT SOAK	SUPPLEMENTAL 2 DAY DIURNAL +HOT SOAK
LDVs and LLDTs	0.95	1.2
HLDTs	1.2	1.5

v. Passenger Vehicles Above 8,500 pounds GVWR

Historically, all vehicles above 8,500 pounds GVWR have been categorized as heavy-duty vehicles regardless of their application and they have been subject to standards and test procedures designed for vehicles used in heavier work applications[7]. In the Final Rule, EPA is finalizing Tier 2 standards for passenger vehicles above 8,500 pounds GVWR. These vehicles are included in the Tier 2 program beginning in 2004 and are required to meet the final Tier 2 standards in 2009 and later. These vehicles will generally be subject to the same requirements as HLDTs.

The Rule creates a new category of heavy-duty vehicles termed “medium-duty passenger vehicles” (MDPVs). These vehicles will generally be grouped with and treated as HLDTs in the Tier 2 program. The MDPV category is defined as any complete heavy duty vehicle less than10,000 pounds GVWR designed primarily for the transportation of persons including conversion vans (i.e., vans which are intended to be converted to vans primarily intended for the transportation of persons. The conversion from cargo to passenger use usually includes the installation of rear seating, windows, carpet, and other amenities). EPA is not including any vehicle that (1) has a capacity of more than 12 persons

7/ The heavy-duty definition also includes vehicles that weigh over 6000 lbs curb weight regardless of their GVWR.

total or, (2) that is designed to accommodate more than 9 persons in seating rearward of the driver's seat or, (3) has a cargo box (e.g., a pick-up box or bed) of six feet or more in interior length.

As noted above, the MDPVs and HLDTs must meet the final Tier 2 standards by 2009 at the latest. Prior to 2009, HLDTs and MDPVs are required to meet interim standards. The interim standards are based on a corporate average full life NOx standard of 0.20 g/mile which is phased in 25/50/75/100 percent in 2004-2007. MDPVs must be grouped with HLDTs for the interim standards phase-in.

EPA is providing an additional upper bin for MDPVs for the interim program (effective in model years 2004 through 2008). This bin would only be available for MDPVs. The bin, shown in the Table below, is equivalent to the California LEV I standards that are applicable to these vehicles prior to 2004. Vehicles certified to this bin must be tested at adjusted loaded vehicle weight (ALVW), consistent with California program testing requirements.[8] Including this upper bin provides manufacturers with the ability to carry over their California vehicles to the federal program prior to their phase-in to the interim and final Tier 2 standards. Once phased in to the interim standards manufacturers may continue to use the upper bin but the vehicles must be included in the 0.20 g NOx average. The upper bin is not available to manufacturers for the final Tier 2 program.

Temporary Interim Exhaust Emission Standards Bin for MDPVs[a]

	NOx	NMOG	CO	HCHO	PM
Full Useful Life (120,000 mile)	0.9	0.280	7.3	0.032	0.12

NOTES

a. Bin expires after model year 2008.

For diesel MDPVs prior to 2008, EPA is allowing manufacturers the option of meeting the heavy-duty engine standards in place for the coinciding model year. Diesels meeting the engine-based standards would be excluded from the interim program averaging pool. In 2008, the manufacturers must chassis certify diesel vehicles and include them either in the interim program or in the final Tier 2 program. In 2009 and later, all MDPVs, including diesels, must be brought into the final Tier 2 program. As with the higher bin of chassis-based standards, the purpose of this diesel provision is to provide the option of carry-over of vehicles until they are brought into the Tier 2 program.

For diesel engines that are engine certified and used in MDPVs, as allowed through model year 2007, EPA is requiring those engines to comprise a separate averaging set under the averaging, banking and trading requirements applicable to heavy-duty diesel engines. EPA is permitting engine-based certification for these diesel vehicles to provide time and flexibility for manufacturers who may have limited experience with chassis certifying vehicles containing such engines. However, EPA believes it is appropriate to constrain the application of credits to these engines.

8/ ALVW is the average of curb weight and GVWR. The test weight is sometimes referred to as "half payload".

MDPVs placed in bin 10 may also certify to the higher NMOG level of 0.280 g/mile. This provision provides manufacturers with the incentive of selecting the lower NOx bin for MDPVs, since the NMOG level is not an obstacle to compliance.

Manufacturers have two options for the start of the program requirements. In Option 1, the program begins with the 2004 model year for 25 percent all vehicles. In Option 2, manufacturers can exempt 2004 model year vehicle test groups whose model years begin on or after the fourth anniversary of this rule's signature. These options are also available for MDPVs. However, the additional 0.9 g bin, the optional higher NMOG standard of 0.280 g/mile for bin 10, and the option of certifying to the engine-based standards for diesels are available only with Option 1.

EPA is requiring all non-diesel MDPVs to be OBDII compliant beginning in 2004. California requires OBDII for their LEV I program and therefore, the new OBD II requirements are consistent with the approach of allowing vehicles to be carried over from California[9]. Diesel vehicles which are carried over from the California program are required to be equipped with the OBD system as the system is certified in California. Diesel vehicles not carried over from California are not required as part of this Rulemaking to be equipped with OBDII. However, EPA has proposed OBD II requirements for heavy-duty diesel engines in its heavy-duty engines NPRM; if OBDII requirements are finalized for heavy-duty engines and vehicles as part of that Rulemaking the OBD II requirements would likewise apply to diesels in the MDPV category.

EPA is finalizing Cold CO and Certification Short Test requirements for Tier 2 MDPVs. However, they are not finalizing SFTP standards for MDPVs in this Rule. Currently, SFTP standards do not apply to any vehicles above 8,500 pounds GVWR, including those in the California LEV I and LEV II programs.

d. Sulfur Provisions

The other major part of the Rule will significantly reduce average gasoline sulfur levels nationwide. EPA expects these reductions could begin to phase in as early as 2000, with full compliance for most refiners occurring by 2006. Importers of gasoline will be required to import and market only gasoline meeting the sulfur limits. Temporary, less stringent standards will apply to a few small refiners through 2007. In addition, temporary, less stringent standards will apply to a limited geographic area in the western U.S. for the 2004-2006 period.

The program requires that most refiners and importers meet a corporate average gasoline sulfur standard of 120 ppm and a cap of 300 ppm beginning in 2004. By 2006, the cap will be reduced to 80 ppm and most refineries must produce gasoline averaging no more than 30 ppm sulfur. The program includes provisions for trading of sulfur credits.

The Table below summarizes the standards for gasoline refiners and importers. There are three standards which refiners and importers must meet. In 2004 and beyond, every gallon of gasoline produced is limited by a per-gallon maximum or "cap." The cap standard becomes effective January

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9/ As with HLDTs, the California OBDII compliance option is available for MDPVs.

1, 2004 (and January 1 of subsequent years as the cap standard changes). Also, in 2004 and 2005, each refiner must meet an annual-average standard for its entire corporate gasoline pool. Finally, each individual refinery is subject to a refinery average standard, beginning in 2005. Refineries that do not take advantage of the sulfur ABT program will have actual sulfur levels averaging 30 ppm beginning in 2005.

Gasoline Sulfur Standards for Refiners, Importers, and Individual Refineries (Excluding Small Refiners and GPA Gasoline)

Compliance as of:	2004[a]	2005	2006+
Refinery Average, ppm[b]	--	30	30
Corporate Pool Average, ppm[c]	120	90	--
Per-Gallon Cap[d], ppm	300	300	80

NOTES

[a] EPA projects that the pool averages will actually be below 120 ppm in 2004.

[b] The refinery average standard can be met through the use of sulfur credits or allotments from the sulfur ABT program, as long as the applicable corporate pool average and per-gallon caps are not exceeded.

[c] The corporate pool average standard can be met through the use of corporate allotments obtained from other refiners, if necessary.

[d] In 2004, exceedances up to 50 ppm beyond the 300 ppm cap are allowed. However, in 2005, the cap for all batches will be reduced by the magnitude of the exceedance.

e. Emissions Reductions and Costs

These reductions will come at an average cost increase of less than $100 per passenger car, an average cost increase of less than $200 for light trucks, and an average cost increase of about $350 for medium-duty passenger vehicles, and an average increase of less than 2 cents per gallon of gasoline (or about $120 over the life of an average vehicle).

4. Conclusions

Both the California LEV II and EPA Tier 2 programs will substantially lower emissions from light and medium duty vehicles in future years. Especially significant is the decision in both programs to set fuel neutral standards and to require all vehicles used primarily for personal transportation to meet the same limits. There are several distinctions between the programs however that are worth highlighting.

a. Final Emissions Levels - Light Duty Vehicles

The maximum average NMOG and NOx emissions standards under the LEV II and Tier 2 programs after complete phase in is shown below. Levels are down dramatically in both cases from current levels with LEV II levels marginally lower than Tier 2 because of the ZEV mandate and the need to introduce SULEV vehicles to meet the NMOG corporate average standard. However, it is important to note that since the Tier 2 program includes the ZEV and SULEV bins, manufacturers may opt to sell more of these vehicles than mandated and could achieve similar levels as under LEV II.

Average Full Life Emissions Standards (g/mile)

	NMOG		NOx	
	PC/LDT1	LDT2	PC/LDT1	LDT2
LEV II	0.04385	0.0556	0.0505	0.0625
Tier 2	< .09	< .09	0.07	0.07

As noted earlier, the LEV II program allows up to 4% of the manufacturers production of LDT2s with a payload equal to or greater than 2500 lbs to achieve a marginally higher NOx standard; if a manufacturer takes full advantage of this, the average full life NOx standard for these vehicles could rise to 0.64 grams/mile.

b. Final Emissions Levels - Medium Duty Vehicles

After full implementation, average lifetime emissions under LEV II and Tier 2 for vehicles between 8,500 and 10,000 lbs. GVW are summarized below.

Average Full Life Emissions Standards (g/mile)

	NMOG	NOx
LEV II	0.1638	0.2
Tier 2	0.09	0.07

Again, in both cases, emissions are substantially lower for this class of vehicles than is presently allowed. However, Tier 2 vehicles are marginally cleaner since they must comply on average with the same 0.07 grams/mile NOx standard as passenger cars.

California's definition of medium duty vehicles extends up to 14,000 lbs. GVW whereas the federal definition of MDPCs extends only to 10,000 lbs. The LEV II MDVs between 10,000 and 14,000 lbs are therefore substantially cleaner than the federal vehicles in this same weight class. EPA has indicated its intention to phase in substantially tighter standards for all heavy duty on road vehicles and engines starting in 2007 but the Notice of Proposed Rulemaking has not yet been issued and it remains to be seen what the final standards will be.

c. Interim Emissions Levels

One of the especially innovative approaches of the Tier 2 package is the introduction of stringent interim standards for light duty trucks. The NOx emission standards for LDT2s, LDT3s and LDT4s, which comprise about 40 percent of the fleet, are more stringent than the corresponding standards in the NLEV and CAL LEV I programs.

d. Evaporative Emissions

Both California and EPA have the same running loss evaporative standard but both of the diurnal and hot soak standards are much tighter in California than in the Federal program. In addition, the California evaporative standards apply for 150,000 miles compared to 120,000 miles for the Federal.[10]

Evaporative Emissions Standards (grams/test)

Vehicle Class	3-Day Diurnal + Hot Soak	
	California	Federal
Passenger Cars	.5	.95
Light Duty Trucks < 6000 lbs. GVW	.65	.95
Light Duty Trucks 6000-8500 lbs. GVW	.9	1.2
Medium Duty Vehicles under 10,000 lbs. GVW	1.0	1.4

Vehicle Class	2-Day Diurnal + Hot Soak	
	California	Federal
Passenger Cars	.65	1.2
Light Duty Trucks < 6000 lbs. GVW	.85	1.2
Light Duty Trucks 6000-8500 lbs. GVW	1.15	1.5
Medium Duty Vehicles under 10,000 lbs. GVW	1.25	1.75

The tighter evaporative standards will also reduce toxic emissions such as benzene.

e. Advanced Technology

A tremendous amount of progress has occurred over the past thirty five years in cleaning up conventional vehicles using internal combustion engines. However as clean as these vehicles are when new, retaining low emissions over the actual life of the vehicle is much more problematic and is dependent not only on the durability of the emissions control system but also on the determination of the vehicle owner to perform all necessary maintenance, the competence of the service industry

10/It should be noted that California gasoline has a low volatility of 7 lbs. RVP.

in performing that maintenance, the quality of replacement parts, the degree to which individuals know when a failure has occurred and the willingness and ability to correct it, etc. This is not only true during the first 10,000 or 50,000 or even 100,000 miles or with the first owner of the vehicle, but beyond that mileage and with second, third or even fourth or more vehicle owner. Current data on vehicle miles traveled indicate that, on average, passenger cars are driven 122,000 miles, light-duty trucks 110,000 miles, and medium-duty vehicles 118,000 miles **during their first ten years of life**. In fact, the ARB's inventory shows that approximately 20 percent of all vehicle miles traveled are from vehicles that have accumulated between 100,000 and 150,000 miles. Not surprisingly, since internal combustion engines are not inherently clean, emissions tend to degrade in use over time and mileage and average emissions tends to rise above the standard.

In addition, as clean as the internal combustion engine powered vehicles have become, overall mileage continues to increase which continues to put pressure on to achieve lower and lower levels per mile driven.

To solve these problems, California has included a zero emissions vehicle component for several years to stimulate the development and production of inherently clean, zero and near zero emissions technology. The EPA program on the other hand, while allowing ZEV technology, does not mandate its use. This is a very clear cut and significant advantage of the California program.

f. Potential For Dirtier Vehicles

The EPA Tier 2 program includes several bins that are higher than any of the bins allowed in California, opening up the possibility of prolonging the use of dirtier technologies. For example, bins 6, 7 and 8 allow higher emissions than any of the California bins. This increases the risk for example that more diesel vehicles will be able to be sold under the federal program than under the California program. These vehicles, even with the stringent Tier 2 requirements, will emit higher amounts of particulate and other toxic emissions. It should be noted that selling vehicles in these higher bins will necessitate selling even greater amounts of vehicles in the lower bins (e.g., SULEVs and ZEVs) to maintain the overall fleet average.

g. Leadership

Over the course of the past thirty five years, California has consistently demonstrated leadership in developing and implementing motor vehicle pollution control. The list is long but development of OBD requirements and the ZEV mandate are just two recent examples. While California and EPA have collaborated closely in recent years to the benefit of both programs, it appears more likely that whatever the future challenges will be California is likely to show the necessary leadership to develop innovative solutions and incorporate them more rapidly into their program.

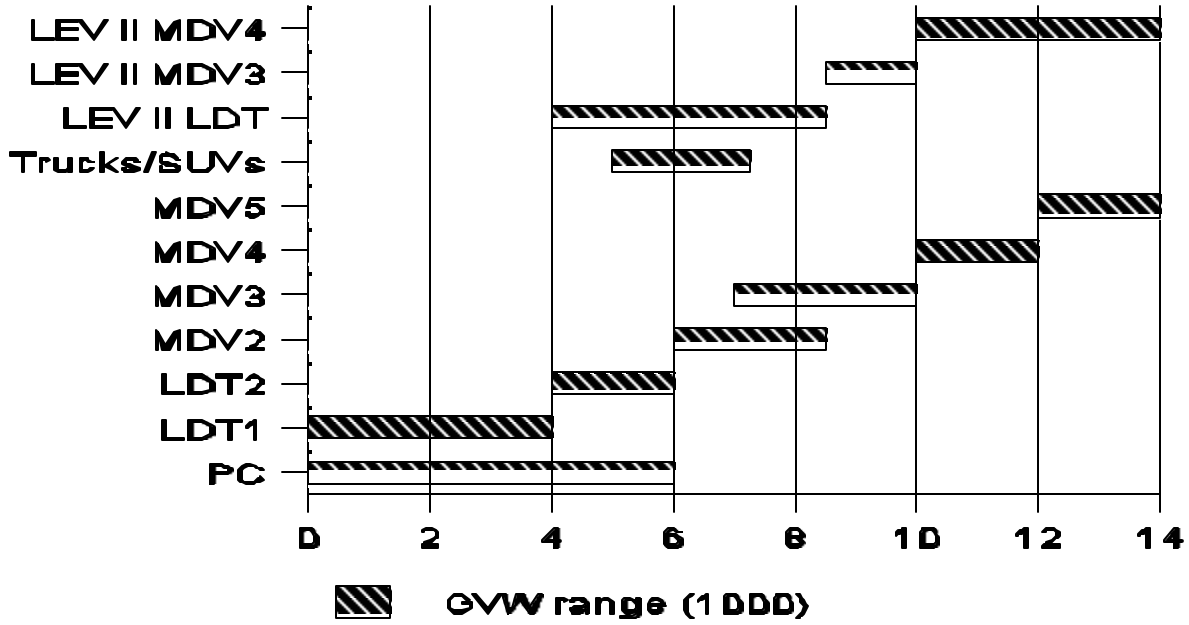
LEV II MDV4
LEV II MDV3
LEV II LDT
Trucks/SUVs
MDV5
MDV4
MDV3
MDV2
LDT2
LDT1
PC
0
2
4
6
8
10
12
14
GVW range (1000)

Figure 1