# APPENDIX B

# SUMMARY OF THE CALIFORNIA AND FEDERAL LIGHT- AND MEDIUM-DUTY VEHICLE PROGRAMS

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## SUMMARY OF THE CALIFORNIA LEV II AND FEDERAL TIER 2 PROGRAMS TO CONTROL EMISSIONS FROM LIGHT- AND MEDIUM-DUTY VEHICLES

## I. The California LEV II Program

### A. The Original California Low-Emission Vehicle (LEV I) Program

In September 1990, the Air Resources Board (ARB or Board) adopted the original California Low-Emission Vehicle (LEV I) regulations, requiring automobile manufacturers to introduce progressively cleaner light- and medium-duty vehicles with more durable emission controls from 1994 through 2003. The LEV program is California's long-term plan to achieve the greatest possible emission reductions in the most efficient manner. The LEV I regulations provided manufacturers with the stability needed to optimize resources for accomplishing product changes and advance notice for them to invest in developing advanced vehicle technologies to meet California's clean air goals.

The LEV I regulations included three primary elements:

(1) Tiers of exhaust emission standards for increasingly stringent categories of low-emission vehicles;

(2) A mechanism requiring each manufacturer to phase-in a progressively cleaner mix of vehicles from year to year with the option of credit trading; and

(3) A requirement that a specified percentage of passenger cars and lighter light-duty trucks be ZEVs, vehicles with no emissions. Since the current rulemaking does not affect the ZEV requirements, a very abbreviated discussion of ZEVs is provided.

#### 1. The LEV I Exhaust Emission Standards

The LEV I program established four low-emission vehicle categories to which a passenger car or lighter light-duty truck could be certified: Transitional Low-Emission Vehicle (TLEV), Low-Emission Vehicle (LEV), Ultra Low-Emission Vehicle (ULEV) and ZEV. For medium-duty vehicles, there are four categories: LEV, ULEV, Super Ultra Low-Emission Vehicle (SULEV) and ZEV. Light- and medium-duty vehicles could also be certified to the preexisting exhaust emissions standards, which were called the "Tier 1" standards.

Each low-emission vehicle category has had a progressively more stringent standard for exhaust emissions of nonmethane organic gas (NMOG), a precursor of ozone pollution in the lower atmosphere. For example, a passenger car TLEV has had to meet an NMOG emission standard that is about one-half of the corresponding basic standard for 1994 model vehicles. Passenger car LEVs and ULEVs have had to meet standards for NMOG that are respectively

about one-third and one-sixth of the corresponding 1994 standard. The identical LEV and ULEV standard for oxides of nitrogen (NOx) has represented a 50% reduction from the basic NOx standard for 1994 passenger cars, and the ULEV standard for carbon monoxide (CO) also represents a reduction of about 50% from the basic 1994 CO standard.

All passenger cars were subject to the same low-emission vehicle standards, regardless of weight. However, for light-duty trucks and medium-duty vehicles, the numerical standards for each low-emission vehicle category depended on the weight classification of the vehicle. As shown in Table 1, there were two weight categories (LDT1 and LDT2) for light-duty trucks, which can have a gross vehicle weight (GVW) of up to 6,000 pounds. For medium-duty vehicles, which have a GVW of 6,000-14,000 pounds, there were effectively four weight categories: MDV2, MDV3, MDV4 and MDV5.

The lightest light trucks making up the LDT1 category, such as the Toyota RAV4 and Ford Ranger, had to meet the same standards as passenger cars. The medium-light trucks in the LDT2 category, such as the Jeep Grand Cherokee and essentially all mini-vans, were allowed to emit about 25-33% more NMOG and CO, and 75-100% more NOx, than passenger cars in the same low-emission vehicle categories. The MDV2 category included heavier vehicles such as the Ford F150, which were subject to the same NOx standards as LDT2s, but could emit about 110-150% more NMOG than equivalent passenger cars. The MDV3 category included vehicles such as the Dodge Ram 1500 truck, Ford Expedition and most Suburbans, which were subject to LEV emission levels for NMOG and NOx that were 160% and 200% higher than those for passenger cars. The MDV4 and MDV5 categories included vehicles such as the Ford Excursion, the largest Suburban model, and the Dodge Ram 2500 and 3500 trucks.

The complete set of LEV I 50,000-mile emission standards to which vehicles could be certified under the LEV I program is shown in Table 1. There are additional emission standards at 100,000 miles for passenger cars and light-duty trucks and at 120,000 miles for medium-duty vehicles. The 100,000 and 120,000 mile standards included standards for particulate from diesel vehicles.

### 2. The LEV I Requirements for Phasing-in a Cleaner Vehicle Fleet

The LEV I regulations feature an increasingly stringent annual fleet average NMOG emission requirement, which provides a flexible mechanism for phasing-in low-emission vehicles. For each model year, an auto manufacturer may produce passenger cars and light-duty trucks certified to any combination of emission levels – Tier 1, TLEV, LEV, ULEV, and SULEV – as long as the NMOG fleet average requirement is met across the manufacturer's full model line. The required annual fleet average NMOG emissions levels, based on the 50,000-mile NMOG standards, start at the Tier 1 level for the 1994 model year, and then become incrementally more stringent through the 2003 model year. Table 2 shows the fleet average NMOG requirements for passenger cars and light-duty trucks for each model year. The 2003 model-year level was derived from a potential vehicle mix of 75% LEVs, 15% ULEVs and 10% ZEVs. The heavier light-duty trucks have been subject to numerically higher fleet average NMOG emissions requirements reflecting the numerically higher TLEV, LEV and ULEV standards and the absence of ZEV requirements.

## Table 1: The California LEV I Exhaust 50,000-Mile Emission Standards

**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) | 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 |
| LDT2s (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 |
| MDV2s (3751-5750 lbs. TW) | 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 | 9 | n/a |
| MDV3s (5751-8500 lbs. TW) | 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 |
| MDV4s 8501 -10,000 lbs. TW | 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 |
| MDV5s 10,001-14,000 lbs. TW | 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 |

**Table 2: Fleet Average NMOG Requirements**
**(gram/mile, based on 50,000-mile standards)**

| *Vehicle Category* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* | *2000* | *2001* | *2002* | *2003+* |
|---|---|---|---|---|---|---|---|---|---|---|
| PC and LDT1 (0-3750 LVW) | 0.250 | 0.231 | 0.225 | 0.202 | 0.157 | 0.113 | 0.073 | 0.070 | 0.068 | 0.062 |
| LDT2 (3751-5750 LVW) | 0.320 | 0.295 | 0.287 | 0.260 | 0.205 | 0.150 | 0.099 | 0.098 | 0.095 | 0.093 |

Medium-duty vehicles have separate requirements based on a percent phase-in schedule, because the numerous vehicle weight classifications and relatively low sales volumes make a fleet average requirement approach more difficult to implement. Table 3 shows the phase-in requirements for medium-duty vehicles. There are two types of MDVs – those that are certified using the chassis dynamometer (the left column of Table 3) and those certified using an engine dynamometer (the right column of Table 3). Chassis-certified vehicles make up about 80 percent of the MDV category, and generally gasoline-powered. The remaining 20 percent of the MDV category are engine-certified vehicles, mostly diesel-powered.

**Table 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 | 40 | 60 | 0 | 0 | 100 |

The regulations also establish a system for earning marketable credits for use in complying with the phase-in requirements.

3. ZEV requirements

As originally adopted, the LEV regulations required that specified percentages of the passenger cars and lightest light-duty trucks produced by each of the seven largest manufacturers be ZEVs, starting in 1998. The percentages were 2% for the 1998-2000 model years and 5% for

the 2001-2002 model years. A requirement of 10% ZEVs applied to all but small-volume manufacturers starting in model-year 2003. In 1996 the Board eliminated the regulatory ZEV requirements applicable prior to the 2003 model year. The ZEV element also includes a marketable credits system.

### B. The LEV II Program

The Low-Emission Vehicle II (LEV II) program, adopted following a November 1998 hearing, is an extension of the original LEV I program and is structured to provide additional reductions needed to achieve California's long term goal of healthful air quality by 2010.

The LEV II amendments include three major interrelated elements designed to reduce exhaust emissions: (1) restructuring the light-duty truck category so that most SUVs, mini-vans and pick-up trucks are subject to the same low-emission vehicle standards as passenger cars, (2) strengthening the NOx standard for passenger car and light-duty truck LEVs and ULEVs, and changing other emission standards, and (3) establishing more stringent 2004 and subsequent model year phase-in requirements for passenger cars, light-duty trucks and medium-duty vehicles. They also contain various other changes, including elimination of the TLEV standard after the 2003 model year and a program for generating partial ZEV allowances.

#### 1. Passenger car standards for light and medium trucks

Under the restructuring of vehicle weight classifications, all current light-duty trucks, and all current medium-duty vehicles having a GVW of less than 8,500 lbs. – basically the MDV2 and MDV3 categories – will be subject to the same LEV and ULEV standards as passenger cars. Only the very heaviest sport-utility vehicles (SUVs) and pick-up trucks in the MDV4 category will remain subject to separate medium-duty vehicle standards, along with MDV5s. When the vehicle categories were first established, the majority of vehicles in the LDT2 and medium-duty categories were primarily used for work purposes. More lenient gram per mile emission standards were developed that account for heavier loads and a potentially more rigorous duty cycle of work trucks. However, it is now very common for trucks and SUVs to be used primarily for personal transportation (i.e., as passenger cars), and light trucks (including SUVs) have increased from 20% of the California vehicle market in 1980 to almost 46% in 1997. This trend has a substantial impact on California's air quality because, although these vehicles are used as passenger cars, they are certified to the more lenient gram per mile emission standards designed for work trucks.

Since most pick-up trucks and SUVs have a curb weight less than 5,500 lbs. and a payload of approximately 1,000-2,000 lbs., it is anticipated that the majority of the heavier trucks will fall in the new LDT2 category below 8,500 lbs. GVW. (Although the same low-emission vehicle standards will apply, the preexisting LDT1 category is retained because of the different fleet average NMOG requirements described below and because only LDT1s are subject to the ZEV requirements.) It appears unlikely that manufacturers will unnecessarily add payload to trigger a numerically higher standard because of the negative impact on fuel economy, performance and cost. In recognition of the fact that some of the heavier trucks in the new truck category will be engineered for more rigorous duty, the regulations allow a small percentage (up

to 4%) of a manufacturer's truck sales in the LDT2 category to be certified to a marginally higher NOx emission standard.

2. **New LEV II Standards**

The LEV II amendments establish new LEV II standards for the current LEV, ULEV and SULEV categories. The LEV II standards, which are shown in Table 4, are more stringent than the corresponding LEV I standards in several respects.

- Most importantly, the LEV II NOx standard for passenger cars and light-duty trucks certified to the LEV and ULEV standards has been reduced by 75% from the prior 0.2 g/mi level to 0.05 g/mi. The 120,000 mile LEV II particulate emission standard is 0.01 g/mi for diesel LEVs, ULEVs and SULEVs, compared to 0.08 g/mi for LEVs and ULEVs under LEV I.

- The overall LEV II emission standards for medium-duty vehicles have been tightened to be substantially equivalent in stringency to the light-truck standards (although numerically higher).

- The useful life for LEV II passenger cars and light-duty trucks has been increased from the current 100,000 miles to 120,000 miles. Manufacturers must show compliance with the full useful life standards over this mileage.

- A new light-duty SULEV category has been created with an NMOG standard less than one-fourth of the level for ULEVs; recent technology developments indicate that gasoline, alternative fuel and hybrid electric vehicles could potentially reach these emission levels.

- Manufacturers will have the option of certifying any LEV, ULEV or SULEV to a 150,000-mile certification standard, in which case the vehicle will generate greater NMOG credits for the fleet average NMOG determination. A manufacturer electing this option will have to provide an 8-year/100,000-mile warranty for high cost parts rather than for the normal 7 years/70,000 miles. (The 150,000-mile standards are not shown in Table 4).

- Manufacturers can receive credit for the early introduction of larger trucks and SUVs meeting a 0.2 g/mi NOx emission level and certified to the LEV I LEV and ULEV standards; this credit can be used in the 2004-2008 model years on like vehicles certifying to the LEV and ULEV 0.05 g/mi NOx standards. A similar option is available for MDVs.

The Board eliminated the TLEV standards after the 2003 model year, concluding that the more stringent standards for the other vehicle emission categories could be met by gasoline and alternative fuel vehicles, and it was inappropriate to allow substantially higher NOx and particulate levels to assure availability of diesel vehicles. In the 1999 model year, only a small number of new diesel passenger cars were being sold in California, and no new diesel light-duty

trucks were being marketed. There were also no California diesel models in the MDV2 and MDV3 categories that would be subject to the passenger car standards under LEV II; diesel pickup trucks being sold in the MDV 4 and MDV5 weight categories would not become subject to the passenger car standards and are not affected by elimination of the TLEV category.

**Table 4: 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* | *Mileage for Compliance* | *Vehicle Emission Category* | *NMOG (g/mi)* | *Carbon Monoxide (g/mi)* | *Oxides of Nitrogen (g/mi)* | *Formaldehyde (mg/mi)* | *Diesel Particulate[1] (g/mi)* |
|---|---|---|---|---|---|---|---|
| All PCs; LDTs <8,500 lbs. GVW | 50,000 | LEV | 0.075 | 3.4 | 0.05 | 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 |
| | | ULEV | 0.055 | 2.1 | 0.07 | 11 | 0.01 |
| | | SULEV | 0.010 | 1.0 | 0.02 | 4 | 0.01 |
| MDVs 8501 – 10,000 lbs. GVW (MDV4) 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 |
| MDVs 10,001-14,000 lbs. GVW (MDV5) 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 |

*Phasing in the LEV II standards.* Over the 2004-2007 model years, manufacturers are required to phase in certification of models to the LEV II emission standards in place of the LEV I standards. For passenger cars and vehicles currently classified light-duty trucks, a manufacturer must certify its vehicles to the LEV II standards at a rate of at least 25/50/75/100% during 2004-2007. A manufacturer may use an alternative phase-in schedule if it achieves equivalent NOx reductions by the 2007 model year. A manufacturer of vehicles classified as MDVs under both LEV I and LEV II (8501 – 14,000 lbs. GVWR) must phase-in at least one test group a year to the LEV II standards, with full compliance by the 2007 model year. Vehicles that were treated as MDVs under LEV I but will be in the LDT2 category under LEV II – i.e. the MDV2 and MDV3 categories – do not have to be certified to the LEV II standards until the 2007 model year, when 100 percent compliance is required. In California, the MDV2 and MDV3 categories each make up about 8% of the total number of vehicles that will be subject to the passenger car standards under LEV II.

### 3. Requirements for phasing-in a cleaner vehicle fleet

For passenger cars and light-duty trucks, the LEV I annual fleet average NMOG requirements continue to apply through the 2003 model year. The LEV II regulations provide for continuing yearly reductions from the 2004 through 2010 model years as shown in Table 5. Although each manufacturer can select its own vehicle mix, one approach in meeting the 2010 requirement for passenger cars and LDT1s would be a fleet made up of 18% LEVs, 47% ULEVs, 25% SULEVs and 10% ZEVs. The fleet average NMOG levels are numerically higher because no ZEVs are projected in this class and a longer phase-in period for ULEVs and SULEVs is provided.

**Table 5: LEV II Fleet Average NMOG Requirements for PCs and LDTs (g/mi)**

| *Vehicle Category* | *2004* | *2005* | *2006* | *2007* | *2008* | *2009* | *2010+* |
|---|---|---|---|---|---|---|---|
| PCs; LDT1s | 0.053 | 0.049 | 0.046 | 0.043 | 0.040 | 0.038 | 0.035 |
| LDT2s | 0.085 | 0.076 | 0.062 | 0.055 | 0.050 | 0.047 | 0.043 |

For medium-duty vehicles, the requirement of a 60/40 mix of LEVs and ULEVs in 2004 and subsequent model years – shown in Table 3 – is changed to 40/60.

## II. The Federal Tier 2 program

### A. Background

The federal Tier 2 program grew out of requirements and limitations imposed by the 1990 amendments to the federal Clean Air Act (CAA). In 1990, Congress mandated the exhaust emission standards that would apply to passenger cars, light-duty trucks and lighter medium-duty vehicles after the 1993 model year. Passenger cars and light-duty trucks would be subject to "Tier 1" standards essentially identical to the California standards applicable to 1994 model-year vehicles – California's use of the term "Tier 1" is actually borrowed from the federal program. The Tier 1 standards were to be phased in over the 1994-1996 model-years. (CAA § 202(g).) The category of vehicles California calls MDV2 and MDV3 is called "heavy light-duty truck" or "HLDT" under the federal program; these vehicles were to be subject to Tier 1 standards that were phased-in over during the 1996 and 1997 model years. Again, these standards were essentially identical to the California Tier 1 standards for these vehicle classes. (CAA § 202(h).)

Congress prohibited U.S. EPA from adopting more stringent standards for passenger cars, light-duty trucks and medium-duty vehicles prior to the 2004 model year. (CAA § 202(b)(1)(C).) Instead, the Clean Air Act directed U.S. EPA to conduct what became known as the "Tier 2" study to examine the need for and technological feasibility and cost-effectiveness of more stringent standards beginning between the 2004 and 2006 model years.

In February 1993, the 13 northeastern states making up the Ozone Transport Region (OTR) submitted a petition to the U.S. EPA requesting the federal agency to require all OTR states to adopt the California LEV program under section 177 of the CAA. In response, U.S.

EPA worked with vehicle manufacturers, various states and other parties to develop a "National LEV" program, under which the manufacturers would voluntarily agree to market cars and light trucks with emissions averaging at the LEV I LEV level in all states outside California. The advantage to the OTR states was that not only would the vehicles sold in those states have emissions substantially lower than under Tier 1, but the vehicles migrating in from other states would be cleaner as well. The advantage to the automakers was that the National LEV program would not require cars or light trucks meeting the California ULEV or ZEV standards. In addition, the eight major automakers who had been subject to the California requirement for 2% ZEVs starting in 1998 entered into Memoranda of Agreement with the ARB, committing to offset the emissions loss in the state from postponement of the ZEV requirements by participating in the National LEV program (or the equivalent) and thus assuring that cleaner cars would migrate to California. U.S. EPA designed the National LEV program with the objective that the additional benefits to the northeastern states from the introduction of cleaner cars nationwide would be at least as great as the additional benefits from the states' adoption of the California LEV program with its ZEV requirements and its fleet average NMOG requirement dropping below the LEV level starting in model-year 2000.

After much activity on a variety of fronts, U.S. EPA issued a final National LEV rule in 1997 (62 F.R. 31192 (June 6, 1997)) and a supplemental final rule in 1998 (63 F.R. 926 (January 7, 1998).) Ultimately, 9 of the 13 OTR states and all 23 vehicle manufacturers agreed to participate in the National LEV program, which U.S. EPA found to be in effect in March 1998 (63 F.R. 11347 (March 9, 1998).) Four OTR states – New York, Massachusetts, Vermont and Maine – chose instead to adopt the California LEV program pursuant to CAA section 177.

The National LEV program required the introduction of cleaner cars and light trucks in the 9 participating OTR states starting in the 1999 model year, and nationwide staring in the 2001 model year (except for California and the four states administering the California program). Manufacturers can certify vehicles to the California Tier 1, TLEV, LEV, ULEV and ZEV standards, as long the fleet average reaches the LEV NMOG standards of 0.075 g/mi for passenger cars and LDTs and 0.100 g/mi for LDTs by the 2001 model year. The National LEV standards would were to end after the 2003 model year, or apply until Tier 2 takes effect, depending on what action U.S. EPA took on Tier 2.

The National LEV program did not apply to the federal heavy light-duty truck (HLDT, made up of LDT3 and LDT4) category, which is equivalent to California's MDV 2 and MDV3 categories. Through the 2003 model year, these vehicles were subject to Tier 1 exhaust emission full life NOx standards of 0.98 g/mi (LDT3/MDV2) and 1.53 g/mi (LDT4/MDV3); the 50,000 mile NOx standards were 0.7 g/mi and 1.1 g/mi respectively.

### B. The Federal Tier 2 Regulations

On December 21, 1999, the U.S. EPA issued its Tier 2 regulations, which establish new more stringent exhaust emission requirements for all U.S. light- and medium-duty vehicles not subject to the California standards. (65 F.R. 6698 (February 10, 2000).) Although differing in several respects from the California program, the Tier 2 regulations were designed to be compatible with LEV II and to allow harmonization of federal and California vehicle technology.

Like the LEV II regulations, the Tier 2 regulations are complex, reflecting U.S. EPA's interest in providing vehicle manufacturers with as much flexibility as possible given the overall emission-reduction goals. The key elements of the Tier 2 exhaust emissions requirements are:

(1) A set of 10 different emission standard "bins" for cars and light trucks that function in the same manner as the vehicle emission categories (e.g. LEV and ULEV) in the California program;

(2) A fleet average requirement for NOx instead of NMOG, under which all of the vehicles subject to the car and light truck LEV II standards, along with heavier "medium-duty passenger vehicles" (MDPVs), will have to meet a 120,000 mile fleet average NOx requirement of 0.07 g/mi for each manufacturer when phase-ins are complete starting in the 2009 model year; and

(3) Several interim phase-in requirements for various classes of vehicles, which in some cases include interim standards and fleet average requirements.

1. **The Tier 2 emission bins.**

Tables 6 and 7 show the 10 Tier 2 emission standards bins, plus the eleventh bin that applies only to pre-2008 MDPVs only. Except in the case of MDPVs, bins 9 and 10 apply only through the 2006 model year. Bins 1 through 10 are available to vehicles in all weight categories. Bins 8, 9 and 10 have optional less stringent NMOG standards that apply for qualifying LDT4s and MDPVs only; for bin 10 that is the case with CO and HCHO as well. It is expected that moderately well-controlled diesel engines in SUVs and pickup trucks could meet the standards for the least stringent bins.

2. **The final fleet average NOx requirements.**

The Tier 2 regulations employ a fleet average requirement for NOx instead of NMOG. When phase-ins are complete starting in the 2009 model year, all of the vehicles subject to the LEV II standards for cars and light trucks, along with MDPVs, will have to meet a fleet average NOx requirement of 0.07 g/mi for each manufacturer. The Tier 2 program includes a credit feature similar to that in the LEV II program. In years when a manufacturer's corporate average NOx emissions fall below 0.07 g/mi, it will generate credits. It can trade or sell those credits to other manufacturers or use them in years when its fleet average NOx level is greater than 0.07 g/mi.

3. **Interim fleet average requirements for various weight categories.**

All 2004 and subsequent model vehicles subject to the Tier 2 program must be certified to the standards for one of the available emission bins. This means that no 2004 or subsequent model HLDT may be certified to a 120,000 mile NOx standard greater than 0.6 g/mi. In comparison, the California LEV I NOx standard for MDV3s is 0.9 g/mi NOx., and manufacturers are allowed to certify California MDV3s to the 0.9 g/mi NOx standard through

the 2006 model year. In addition, various weight categories are subject to interim fleet average phase-in requirements.

**Table 6: Tier 2 Intermediate Useful Life (50,000 mile) Exhaust Emission Standards (grams per mile)**

| *Bin Number* | *NOx* | *NMOG* | *CO* | *HCHO* | *PM* |
|---|---|---|---|---|---|
| 11 | 0.6 | 0.195 | 5.0 | 0.022 | -- |
| 10 | 0.4 | 0.160 | 4.4 | 0.018 | -- |
| 9 | 0.2 | 0.140 | 3.4 | 0.015 | -- |
| 8 | 0.14 | 0.125 | 3.4 | 0.015 | -- |
| 7 | 0.11 | 0.075 | 3.4 | 0.015 | -- |
| 6 | 0.08 | 0.075 | 3.4 | 0.015 | -- |
| 5 | 0.05 | 0.075 | 3.4 | 0.015 | -- |

**Table 7: Tier 2 Full Useful Life (120,000 mile) Exhaust Emission Standards (grams per mile)**

| *Bin Number* | *NOx* | *NMOG* | *CO* | *HCHO* | *PM* |
|---|---|---|---|---|---|
| 11 | 0.9 | 0.280 | 7.3 | 0.032 | 0.12 |
| 10 | 0.6 | 0.230 | 6.4 | 0.027 | 0.08 |
| 9 | 0.3 | 0.180 | 4.2 | 0.018 | 0.06 |
| 8 | 0.20 | 0.156 | 4.2 | 0.018 | 0.02 |
| 7 | 0.15 | 0.090 | 4.2 | 0.018 | 0.02 |
| 6 | 0.10 | 0.090 | 4.2 | 0.018 | 0.01 |
| 5 | 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 | 0.02 | 0.010 | 2.1 | 0.004 | 0.01 |
| 1 | 0.00 | 0.000 | 0.0 | 0.000 | 0.00 |

1. Light-duty vehicles and light light-duty trucks (California passenger cars, LDT1s and LDT2s)

During the 2004-2007 model years, the following percentages of a manufacturer's fleet of passenger cars and LLDTs must meet the Tier 2 fleet average NOx requirement of 0.07 g/mi: 25/50/75/100%. During model years 2004-2006, the manufacturer's remaining vehicles in this class must meet an "interim non-Tier 2" fleet average NOx requirement of 0.30 g/mi. Model-year 2001-2003 vehicles in this class are subject to the National LEV standards that are equivalent to average full life NOx levels of about 0.3 g/mi for passenger cars and LDT1s and 0.5 g/mi for LDT2s. The manufacturer may also use an alternative phase-in schedule, and pre-2004 model-year vehicles that the manufacturer elects to have subject to the Tier 2 standards will generate NOx credits.

2. HLDTs (California MDV2s and MDV3s)

For HLDTs, the following percentages of a manufacturer's fleet must meet an "interim non-Tier 2" fleet average NOx standard of 0.20 g/mi over the 2004-2007 model years, aggregated with any MDPVs: 25/50/75/100%. Model-year 2004-2006 HLDTs not certified to the interim non-Tier 2 standard will have to be certified to bin 10 or another bin of greater stringency; this has the effect of imposing a NOx cap of 0.60 g/mi. starting with model-year 2004. During model-year 2008, 50% of the manufacturer's HLDTs will have to meet the Tier 2 fleet average NOx requirement of 0.07 g/mi, with the rest meeting the interim non-Tier 2 fleet average NOx requirement. All 2009 and subsequent model-year HLDTs will be counted under the fleet average NOx requirement of 0.07 g/mi. This category of vehicles is not included in National LEV, so 2001-2003 model-year HLDTs were subject to Tier 1 standards that permit NOx emissions of 0.98 g/mi for LDT3/MDV3s, and 1.53 g/mi for LDT4/MDV3.

3. MDPVs (portion of California MDV4s)

MDPVs are basically grouped with HLDTs during the model years 2004-2009 phase-in. During model years 2004-2007, a manufacturer of MDPVs must certify them to the fleet average NOx requirement of 0.20 g/mi, aggregated with the manufacturer's HLDTs, based on a phase-in of 25/50/75/100%. During these years, the remaining MDPVs may be certified to bin 11 with its 120,000 mile NOx standard of 0.9 g/mi.