

Comparison of California LEV II and Tier 2 Vehicles Programs

TOPIC	California LEV II	Tier 2 NPRM												
Exhaust Emission Standards														
Truck categories	<ul style="list-style-type: none"> Retains LDT1 category equivalent to EPA LDT1s Establishes new LDT2 category equivalent to EPA LDT2, LDT3, and LDT4 categories combined Medium-duty vehicle (MDV) below 8,500 lbs GVW are part of new LDT2 category beginning in 2007. In 2007, MDV becomes a single category containing vehicles between 8,500 and 14,000 lbs GVW 	<ul style="list-style-type: none"> Retains LDT categories (LDT1 - LDT4) LLDTs = LDT1s and LDT2s = below 6,000 lbs GVW HLDTs = LDT3s and LDT4s = 6,000 to 8,500 lbs GVW Adds new category of Medium Duty Passenger Vehicles (MDPV) from 8,501 to 10,000 lbs. GVW Does not include vehicles above 10,000 lbs GVW 												
Light-duty trucks (<8500 lbs GVW)	<ul style="list-style-type: none"> LDTs must meet same standards as passenger cars except: <ul style="list-style-type: none"> 4% of LDT2s sold may certify to marginally higher NOx standard (0.10 vs. 0.07 @ 120k miles), if payload > 2500 lbs. 	<ul style="list-style-type: none"> LDTs must meet same standards as passenger cars HLDTs phased-in later (see below) 												
Corporate Average Standard	Intermediate (50,000 mile) NMOG standard	Full-life (120,000 mile) NOx standard												
NMOG	<ul style="list-style-type: none"> Fleet average standard declines from 2004-2010 LEV I vehicles included in average until phased out in 2007 NMOG average based on 50,000 mile standards: <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="2" style="text-align: center;">NMOG Fleet Average (g/mi) (w/incremental decline each year)</th> </tr> <tr> <th></th> <th style="text-align: center;"><u>2004</u></th> <th style="text-align: center;"><u>2010+</u></th> </tr> </thead> <tbody> <tr> <td>PCs and LDT1s</td> <td style="text-align: center;">0.053</td> <td style="text-align: center;">0.035</td> </tr> <tr> <td>LDT2s</td> <td style="text-align: center;">0.085</td> <td style="text-align: center;">0.043</td> </tr> </tbody> </table> <ul style="list-style-type: none"> LEV II has 4 bins (including ZEV) available for averaging full-life standards for bins = 0.01, 0.055, 0.09 g/mile LDT2 fleet average is higher for two reasons: <ul style="list-style-type: none"> to allow longer phase-in for ULEVs and SULEVs ZEVs are required only for PCs and LDT1s 		NMOG Fleet Average (g/mi) (w/incremental decline each year)			<u>2004</u>	<u>2010+</u>	PCs and LDT1s	0.053	0.035	LDT2s	0.085	0.043	<ul style="list-style-type: none"> Fleet average on NOx rather than NMOG NMOG varies by bin, average of about 0.09 g/mile NMOG standards for bins range from 0.00 to 0.125 g/mile intermediate standard (50k) vary by bin, average about 0.075 g/mile
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NO _x	<ul style="list-style-type: none"> • standard of 0.07 g/mi for all LDVs and LDTs • no bins above 0.07 g/mile except for small volume of LDT2s (see above) • Intermediate standard (50k) of 0.05 g/mile 	<ul style="list-style-type: none"> • Tier 2 LDVs, LDTs and MDPVs corporate average full life standard of 0.07 g/mile • manufacturers choose among bins ranging from 0.0 up to 0.20 g/mile • intermediate standard (50k) varies by bin, averages about 0.05 g/mile • Vehicles not meeting Tier 2 standards during phase-in must meet interim standards (see below)
PM	<ul style="list-style-type: none"> • 0.01 g/mi @ 120,000 miles for all bins 	<ul style="list-style-type: none"> • varies by bin, average of about 0.01 g/mi @ 120,000 miles • bins range from 0.00 to 0.02 g/mile
“Bins” (Sets of emission standards to which a vehicle must be certified).	<ul style="list-style-type: none"> • 3 main “bins” (LEV, ULEV, SULEV) and ZEV. (<i>See Table 1 attached</i>). • Board did not approve the proposed TLEV bin • Introduced SULEV (Super-Ultra LEV) as a new certification category which will likely be used for alternative fuel, gasoline, hybrid electric, and other vehicles. 	<ul style="list-style-type: none"> • 8 bins, 3 above standard and 4 below (<i>see Table 2 and 3 attached</i>) • includes all LEV II bins
Phase-In of Emission Standards	<ul style="list-style-type: none"> • LDVs and LDT1s: 2004-2007 (25/50/75/100%) • LDT2s grouped separately for purposes of phase-in <ul style="list-style-type: none"> - Below 6,000 lbs phased in 2004-2007 (25/50/75/100%) - 6,000-8,500 lbs (considered MDVs under LEV I) phased in 100% in 2007 • Manufacturers may choose alternative phase-in schedule 	<ul style="list-style-type: none"> • LDVs/LLDTs: 2004-2007 (25/50/75/100%) • HLDTs: 2008-2009 (50/100%) • MDPVs: 2008-2009 (50/100%) • Manufacturers may choose alternative phase-in schedule

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Interim Standards (for vehicles not yet phased in)	LEV I	<ul style="list-style-type: none"> • NLEV for LDVs/LDT1s, • LDT2s must meet NLEV LDV/LDT1 standards • HLDTs <ul style="list-style-type: none"> - NOx average of 0.2 g/mile, not to exceed 0.6 g/mile - phased in 2004-2007, 25/50/75/100% - higher bins available compared to Tier 2 • MDPVs <ul style="list-style-type: none"> - NOx average of 0.2 g/mile, not to exceed 0.9 g/mile¹ - phased in 2004-2007, 25/50/75/100% - higher bins available compared to Tier 2 - tested at half payload - diesels can be engine certified prior to 2008
Useful Life	<ul style="list-style-type: none"> • Increased from 100,000 to 120,000 miles for LDVs and LLDTs 	<ul style="list-style-type: none"> • Increased from 100,000 to 120,000 miles for LDVs and LLDTs
Credits	<p>NMOG credits can be generated by:</p> <ul style="list-style-type: none"> • Over achieving declining NMOG average • Certifying to zero-fuel evaporative emissions standard • Certifying to optional 150,000 mile exhaust emissions standard (see below) • Use of ozone reduction technologies (e.g., catalytic coating on radiators which reduces ambient ozone) 	<p>NOx credits can be generated by:</p> <ul style="list-style-type: none"> • Achieving NOx average below 0.07 g/mile • Early banking allowed starting in 2001 • Certifying to optional 150,000 mile exhaust emissions standard (see below)
Credit Deficits	<ul style="list-style-type: none"> • NMOG deficit (average above NMOG requirement not covered by credits) allowed during phase-in period • must be eliminated by 2007 	<ul style="list-style-type: none"> • NOx deficit (average above 0.07 g/mile not covered by credits) can be carried forward one year • Cannot have deficit for two years in a row

¹Equivalent to LEV1 for these vehicles

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Optional 150,000 Mile Standard	<ul style="list-style-type: none"> • Manufacturers that certify to this useful life receive additional NMOG credits toward compliance with fleet average, and must: <ul style="list-style-type: none"> - Certify vehicle to applicable 120k mile standard at 150k miles - Increase emissions warranty (for high cost parts) from 7 yrs/70k miles to 8yr/100k miles - Extend high mileage in-use compliance testing from 75k miles to 105k miles 	<ul style="list-style-type: none"> • Manufacturers that certify to this useful life receive additional NOx credits toward compliance with fleet average, and must: <ul style="list-style-type: none"> - Certify vehicle to applicable 120k mile standard at 150k miles - Extend high mileage in-use compliance testing from 90k miles to 105k miles
In-use standards (for vehicles certified during phase-in)	<ul style="list-style-type: none"> • Relaxed in-use standards, primarily for NOx • For LEV II vehicles certified in 2004 - 2006 • For first two years of sales of the test group 	<ul style="list-style-type: none"> • Relaxed in-use standards for most stringent bins, primarily for NOx • For Tier 2 vehicles certified in 2004-2007 for LDVs and LLDTs and 2008-2009 for HLDTs and MDPVs • For first two years of sales of the test group
Medium-duty vehicles (?8500 lbs GVW)	<ul style="list-style-type: none"> • Most SUVs and pick-up trucks fall into LDT2 category, but largest SUVs pick-ups, and vans are MDVs • Standards substantially equivalent in stringency to light-trucks, but numerically higher (see Table 1) • Tested at ALVW (1/2 payload) • No declining NMOG average, require 60 percent ULEV and 40 percent LEV sales split beginning in 2004 • LEV II Phase-in: 100% by 2007 MY • Useful life = 120,000 miles with optional 150,000 mile useful life available (credits used in LEV/ULEV sales split) 	<ul style="list-style-type: none"> - Adds new category of Medium Duty Passenger Vehicles (MDPV) from 8,501 to 10,000 lbs. GVW • Tier 2 corporate average full life NOx standard of 0.07 g/mile • manufacturers choose among bins ranging from 0.0 up to 0.20 g/mile • intermediate standard (50k) varies by bin, averages about 0.05 g/mile • Vehicles not meeting Tier 2 standards during phase-in must meet interim standards • MDPV Interim Requirements <ul style="list-style-type: none"> - NOx average of 0.2 g/mile, not to exceed 0.9 g/mile² - phased in 2004-2007, 25/50/75/100% - higher bins available compared to Tier 2 - tested at half payload - diesels can be engine certified prior to 2008 Above 10,000 lbs, part of heavy-duty engine/vehicle program
SFTP standards	No changes	<ul style="list-style-type: none"> • Full and intermediate (50k) useful life standards derived from LEV 4,000 mile standards • Standards differ by vehicle category and would apply to diesels

²Equivalent to LEV1 for these vehicles

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Evaporative Emissions Standards		
Evap Standards	<ul style="list-style-type: none"> • Evap emissions = 50% of motor vehicle HC emissions in CA • New standards represent 80% reduction from current standards • Reduced 3-day and 2-day diurnal + hot soak emission standards for all vehicle categories. Running loss standards remain same. • 0.50 grams HC/test for PC's (3-day diurnal + hot soak). Standard varies by vehicle category. <i>(See Table 4 attached).</i> 	<ul style="list-style-type: none"> • 50%+ reduction in the diurnal plus hot soak standards • 3 day diurnal plus hot soak standards <ul style="list-style-type: none"> - 0.95 g/test for LDVs and LLDTs - 1.2 g/test for HLDTs • 2 day diurnal plus hot soak <ul style="list-style-type: none"> - 1.2 g/test for LDVs and LLDTs - 1.5 g/test for HLDTs
Useful Life	Increased to 150,000 miles (or 15 years, whichever occurs first) for all vehicles, because little deterioration expected in first 10 years of vehicle's life. In CA, 20% of VMT is driven from vehicles that have accumulated 100k-150k miles.	Same as exhaust standards
Phase-In	<ul style="list-style-type: none"> • 3 years (2004-2006) • 40/80/100% 	<ul style="list-style-type: none"> • Same as exhaust standards • Can be different sets of vehicles meeting exhaust and evap requirements
Test Procedure	Improved quality control procedures to ensure that measurements are accurate at the new standard levels	Certification durability testing must be conducted using worst case fuel for alcohol content (currently 10 percent)
On-Board Diagnostics		
Leak Detection for Evaporative Systems	Lowered detectable leak size from 0.040 to 0.020 inches (orifice size)	No change to OBD
Phase-In	<ul style="list-style-type: none"> • 4 years (2000-2003) • 20/40/70/100% 	

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CAP 2000		
Program Requirements (streamlined certification with enhanced in-use compliance)	Harmonized with EPA program, with minor exceptions for CA-only programs	No change to program structure
Other		
ZEV	<ul style="list-style-type: none"> • Additional flexibility to broaden scope of vehicles that can qualify as meeting some portion of ZEV requirement • Changes to certification test procedure 	<ul style="list-style-type: none"> • ZEV bin • California test procedures incorporated by reference
Hybrid Electric Vehicle (HEV) Test Procedure	Recently revised by CARB	<ul style="list-style-type: none"> • Manufacturers may propose a contribution factor to EPA for purposes of NOx averaging • California test procedures incorporated by reference
NMOG Test Procedure	Updates laboratory test procedures and suggested operating parameters to provide more accurate and reliable data	No change
Technical Amendments to Standards	- Highlights include: – Tier I standards no longer apply after 2003 MY for LDVs and MDVs – 50? multiplier for SULEVs = 2.0 (same as for LEVs and ULEVs) – SFTP standard for SULEVs same as for LEVs and ULEVs – Cold temperature CO standard for SULEVs = 10.0 g/mi	

Table 1

California LEV II Exhaust Emission Standards								
Vehicle Type	Mileage for Compliance	Vehicle Emission Category (“Bin”)	NMOG (g/mi)	CO (g/mi)	NOx (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate (g/mi)	
All PCs and LDTs <8500 lbs. GVW ³	50,000	LEV	0.075	3.4	0.05	15	N/A	
		LEV ⁴ (option)	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 ² (option)	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	Same numerical emission standards as 120,000 miles					
		LEV ² (option)						
		ULEV						
SULEV								

³Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs).

⁴This optional LEV standard applies to up to 4% of a manufacturer’s LDT2 fleet with a maximum base payload in excess of 2500 lbs.

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MDVs 8500-10,000 lbs. GVWR ⁵	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. GVWR ³	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

⁵Vehicles in this category are tested at their adjusted loaded vehicle weight (curb weight plus ½ payload). Optional 150,000 mile useful life available for MDVs, with credits used to satisfy LEV/ULEV vehicle sales requirements.

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

Bin#	NOx	NMOG	CO	HCHO	PM	Comments
10	0.6	0.156/0.230	4.2/6.4	0.018/0.027	0.08	a,b,c,d
9	0.3	0.090/0.180	4.2	0.018	0.06	a,b,e
The above temporary bins expire in 2006 (for LDVs and LLDTs) and 2008 (for HLDTs)						
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. Bin deleted at end of 2006 model year (2008 for HLDTs).
- b. The higher of the two temporary NMOG, CO and HCHO values apply only to HLDTs.
- c. An additional higher temporary bin restricted to MDPVs is discussed below.
- d. Optional temporary NMOG standard of 0.280 g/mi applies for qualifying LDT4s and MDPVs only.
- e. Optional temporary NMOG standard of 0.130 g/mi applies for qualifying LDT2s only.
- f. Higher temporary NMOG value of 0.156g/mi deleted at end of 2008 model year.

Table 3

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

Bin Number	NOx	NMOG	CO	HCHO	PM	Comments
10	0.4	0.125/0.160	3.4/4.4	0.015/0.018	--	a,b,c,d,f,h
9	0.2	0.075/0.140	3.4	0.015	--	a,b,e,h
The above temporary bins expire in 2006 (for LDVs and LLDTs) and 2008 (for HLDTs)						
8	0.14	0.100/0.125	3.4	0.015	--	b,g,h
7	0.11	0.075	3.4	0.015	--	h
6	0.08	0.075	3.4	0.015	--	h
5	0.05	0.075	3.4	0.015	--	h

NOTES

- a. Bin deleted at end of 2006 model year (2008 for HLDTs).
- b. The higher temporary NMOG, CO and HCHO values apply only to HLDTs and expire in 2008.
- c. An additional higher temporary bin restricted to MDPVs is available.
- d. Optional temporary NMOG standard of 0.195 g/mi applies for qualifying LDT4s and MDPVs only.
- e. Optional temporary NMOG standard of 0.100 g/mi applies for qualifying LDT2s only.
- f. Intermediate life standards are optional for diesels certified to bin 10.
- g. Higher temporary NMOG value deleted at end of 2008 model year.
- h. Intermediate life standards are optional for any test group certified to a 150,000 mile useful life (if credits are not claimed).

Table 4

California Evaporative Emission Standards			
Vehicle Class	Hydrocarbon Standards		
	3-Day Diurnal + Hot Soak (grams per test)	2-Day Diurnal + Hot Soak (grams per test)	Running Loss* (g/mi)
Passenger Cars	0.50	0.65	0.05
Light-Duty Trucks (?8500 lbs. GVWR)			
?6000 lbs. GVWR	0.65	0.85	0.05
6,001-8500 lbs. GVWR	0.90	1.15	0.05
Medium-Duty Vehicles (8501-14,000 lbs. GVWR)	1.00	1.25	0.05
Heavy-Duty Vehicles (> 14,000 lbs. GVWR)	1.00	1.25	0.05

* The running loss standards were not changed from CA’s existing requirements.

Types of Evaporative Emissions:

“Diurnal” emissions are caused by daily ambient temperature changes and occur when a vehicle is parked.

“Hot-soak” emissions are due to high temperatures under the hood, and occur immediately after a fully warmed-up vehicle is stationary with the engine turned off.

“Running loss” emissions occur when a vehicle is driven and can originate from numerous sources within the fuel system and from fuel vapor overflow of the on-board carbon canister.

Purpose of Evap Tests:

- 1) 3-day diurnal + hot soak: ensures control of running loss emissions, high-temperature hot soak emissions, and 3 days of diurnal emissions.
- 2) 2-day diurnal + hot soak: verifies that the carbon canister is well purged during vehicle operation.
- 3) Running loss: measures emissions that occur when vehicle is driven.