January 4, 2000

U.S. EPA Finalizes Tier 2 Standards and Limits on Gasoline Sulfur

On December 21, 1999, President Clinton announced the promulgation of the Tier 2 standards and the limits on gasoline sulfur levels. The action culminates a five-year process that has resulted in the most significant mobile source initiative since the original passenger car standards were established in the 1970 Clean Air Act Amendments. EPA increased the compliance flexibility for both vehicle manufacturers and the oil industry, made some modifications to the interim emission standards, delayed the 30 ppm sulfur average requirement until 2005, gave special, temporary relief to refiners in certain western states, but the timing and stringency of the final Tier 2 standards, as well as the final sulfur limits, were retained.

The program as finalized will: 1) establish new, more stringent standards for light-duty vehicles (passenger cars), light trucks up to 8500 lbs. GVWR, and medium-duty passenger vehicles (8501-10,000 lbs. GVWR) to be phased in between 2004 and 2009 and 2) limit, nationwide, the sulfur levels in gasoline to a 30 ppm average in 2005 with an 80 ppm cap in 2006.

The various vehicle categories covered by the Tier 2 rule are shown in Table 1 below.

Table 1
Light-Duty Vehicles and Trucks and Medium-Duty Passenger Vehicles; Category Characteristics

Vehicle Category	**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 LDT4.
MDPV	A heavy-duty passenger vehicle rated at less than 10,000 lbs. GVWR.

I. The Tier 2 Standards

The phase-in schedule for the Tier 2 standards is shown in Table 2 below.

Table 2
TIER 2 AND INTERIM NON-TIER 2 PHASE-IN AND EXHAUST AVERAGING SETS
(Bold lines around shaded areas indicate averaging sets)

	2001	2002	2003	2004 %	2005 %	2006 %	2007 %	2008 %	2009+ later %	NOx STD. (g/mi)
LDV/LLDT (INTERIM)	NLEV	**NLEV**	**NLEV**	75 max	50 max	25 max				0.30 avg
LDV/LLDT (TIER 2 +evap)	***early banking*** [b]			**25**	**50**	**75**	**100**	**100**	**100**	0.07 avg
HLDT (TIER 2 +evap)	***early banking*** [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. See discussion in text.
d. MDPVs, HLDTs, and MDPVs must be averaged together.
e. Diesels may be engine-certified through the 2007 model year. See discussion in text.

The Tier 2 standards, which are based in large part on California's LEV II program adopted in 1998, require all passenger cars and light trucks to eventually meet the same stringent standards by 2009. The EPA rule does differ from the California program in several respects. First, manufacturers are required to meet a corporate average 120,000 mile 0.07 NOx standard (California established a per vehicle 0.07 gpm NOx requirement, but has a corporate average non-methane organic gas [NMOG] standard). Second, LDT3s and LDT4s are given more time to meet the corporate average 0.07 gpm NOx standard (100% by 2009) compared to passenger

cars and LDT1s and LDT2s (100% by 2007). Third, EPA has included medium-duty passenger vehicles in the program. Finally, since under EPA's rule the manufacturers are able to certify to one of several different sets of standards or "bins", they have the option of certifying diesel engines to slightly less stringent PM (0.02 gpm) and NOx (0.2 gpm) standards than found with the ARB LEV II program.

The cornerstone of the Tier 2 program is that manufacturers may choose to comply by certifying the mix of vehicles to different sets of standards or bins, as long as the corporate average meets the applicable interim or final NOx standard. In the final rule, EPA combined the proposed interim and final Tier 2 standard bins into one set of standard bins. There are eight emission standard bins (1-8) for the final Tier 2 standards and two additional bins (9-10) that are available only during the interim period and will be deleted before the final phase-in of the Tier 2 program. An eleventh bin, discussed below, is available only for MDPVs and expires in 2008. The full-life standards are shown in Table 3 and the intermediate standards are shown in Table 4.

Table 3
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	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	

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 after 2008.
c. An additional temporary higher 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 LDT2a only, see text
f. Higher temporary NMOG standard is deleted at end of 2008 model year

Table 4
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 discussed below.
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, see below.
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).

Emission Standards for Vehicles <6000 lbs. GVWR (LDVs & LLDTs) — The Tier 2 corporate average 120,000 mile 0.07 gpm NOx standard for passenger cars (LDV) and light, light-duty trucks (LLDT) which are made up of LDT1s and LDT2s, will be phased in as follows: 2004 -- 25%, 2005 -- 50%, 2006 -- 75% and 2007 -- 100%. To meet this requirement, manufacturers may certify to one of the available bins (bins 1-8) as shown in Table 3. Manufacturers will have the flexibility to introduce vehicles meeting the Tier 2 standards as early as 2001 and could pursue an alternative phase-in schedule as long as at least 25% of the vehicles are Tier 2 compliant in 2004 and 100% were Tier 2 compliant in 2007. Passenger cars and LLDTs make up 86% of the vehicles in the >8500 lbs. GVWR category.

For passenger cars and light, light-duty trucks not required to meet the Tier 2 standards for 2004-2006, a corporate average 120,000 mile 0.3 gpm NOx standard would apply for these years. To meet this requirement, manufacturers may chose from bins 1-10 as shown in Table 4.

Manufacturers electing to introduce vehicles meeting the Tier 2 standards in early 2001-2004 to generate NOx credits to be used in later years or to be sold to other manufacturers, have the option of certifying to a 100,000 or 120,000 mile useful life. For manufacturers electing the 100,000 mile useful life, the credits would be discounted by 17%. Manufacturers may also

obtain extra NOx credits for the early introduction of vehicles certified to bins 1 or 2 as shown in Table 5 below.

Table 5
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

Emission Standards for Vehicles >6000 lbs. GVWR (HLDTs) – Heavy, light-duty trucks (LDT3 and LDT4) would be required to meet a corporate average 0.2 gpm NOx (120,000 mile) standard to be phased-in on the following schedule: 2004 -- 25%, 2005 -- 50%, 2006 -- 75% and 2007 -- 100%. Those HLDTs not subject to the interim corporate average during the phase-in years would be subject to the least stringent bins so that their NOx emissions will be effectively capped at 0.6 gpm.

The Clean Air Act, however, requires that manufacturers of HLDTs be given at least four years lead time from date the standards are promulgated until the date they take effect. This means that engine test groups introduced before the fourth anniversary of the signing of the Tier 2 rule are not covered under the Tier 2 Program. To address this issue, EPA has provided two compliance options for HLDT interim standards.

Under Option 1, manufacturers would bring their entire production of 2004 model year HLDTs under the interim requirements and phase 25% of them into the 0.20 gpm fleet average requirement, followed by 50% in 2005, 75% in 2006, and then 100% in 2007. Manufacturers electing this option may use a full-life NMOG value through the 2008 model year of 0.280 gpm for LDT4s certified to bin 10 and use a full useful life NMOG value through the 2006 model year of 0.130 gpm for LDT2s certified to bin 9.

Under Option 2, manufacturers may exclude from coverage those 2004 model year test groups whose model years commence before the fourth anniversary of the signature of the Tier 2 program (December 21, 1999). In the case of 2004 model year test groups whose model years commence on or after the fourth year anniversary, the manufacturer must bring all such HLDTs under the requirements of the interim program (e.g., 25% of those vehicles must meet the interim standards in 2004). The manufacturer must bring all of its HLDTs into the interim requirements beginning in 2005, including a 50%, 75% and 100% phase-in to the 0.20 gpm fleet average NOx standard beginning that year.

In 2008, 50% of the heavy, light-duty trucks would be required to meet the corporate average 120,000 mile 0.07 gpm NOx standard and in 2009 100% would be required to meet the corporate average 0.07 NOx standard using the bins shown in Table 3.

Emission Standards for Medium-Duty Passenger Vehicles -- Rather than change the definition of light-duty trucks as EPA proposed in October, the Agency has created a new category of vehicles – medium-duty passenger vehicles (MDPV). EPA defines a MDPV as any complete vehicle <10,000 lbs. GVWR designed for the transportation of persons, including conversion vans. Any vehicle that 1) has a capacity of more than 12 persons or, 2) is designed to accommodate more than 9 persons in seating rearward of the driver's seat, or 3) has a cargo box of six feet or more in interior length is not considered a MDPV.

MDPVs, like HLDTs, must meet the final Tier 2 standards by 2009 at the latest. Prior to 2009 MDPVs are required to meet interim standards. The interim standards are based on a corporate average full life NOx standard of 0.20 gpm which is phased in 25/50/75/100 percent in 2004-2007. MDPVs must be grouped with HLDTs for the interim phase-in. To address concerns expressed by manufacturers regarding workload burden and availability of chassis-testing for diesel vehicles, EPA provided additional flexibility. The Agency created an additional upper bin (bin 11) for use only by MDPVs and only for the interim program (2004-2008) as shown in Table 6.

Table 6
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.

In addition, for diesel MDPVs manufactured prior to 2008, EPA will allow 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 averaging pool. Beginning in 2008, manufacturers must chassis certify diesel vehicles and include them either in the interim program or in the final Tier 2 program.

Evaporative Emission Standards – According to EPA's projections, evaporative emissions from passenger cars and light-duty trucks represent nearly half of the light-duty NMHC inventory estimated for the 2007-2010 time frame. EPA finalized more stringent evaporative standards for all Tier 2 passenger cars and light-duty trucks, which for most vehicles represent more than a 50% reduction in diurnal plus hot soak standards. The standards are shown in Table 7.

Table 7
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

Optional 150,000 Certification – Manufacturers would be given the option of certifying to the applicable 120,000 mile standards and receiving additional NOx credit for the corporate average NOx compliance requirement.

Technological Feasibility Determination – EPA concluded the Tier 2 standards were technologically feasible for gasoline-powered vehicles based on test programs conducted by EPA, ARB and MECA, as well as other information, including the low certification testing levels being achieved by current model year vehicles. EPA stated that the type of control strategies likely to be employed included ongoing improvements in computer software, engine air/fuel controls, improvements in catalyst designs and catalyst/system integration, increases in precious metal loading, and other exhaust system/catalyst system improvements. For diesel-fueled vehicles, EPA stated that exhaust control technology likely would be necessary. For NOx emissions, EPA listed lean NOx catalysts, NOx adsorbers and selective catalytic reduction (SCR) as potential technologies. For PM control, EPA identified oxidation catalysts and PM filter technology. EPA acknowledged that reductions in the level of sulfur in diesel fuel would be necessary to enable the effective use of exhaust control technologies. EPA plans to propose diesel sulfur limits early this year to take effect around 2007.

Costs – As shown in Table 8, EPA estimates the costs of compliance with the Tier 2 requirements would range from under $100 to slightly over $200.

Table 8
Estimated Purchase Price Increases Due to the Tier 2 Standards

	LDV	LDT1	LDT2	LDT3	LDT4/ MDPVs*
Tailpipe standards					
Near-term (year 1)	$78	$70	$125	$245	$258
Long-term (year 6 and beyond)	$49	$45	$97	$199	$208
Evaporative Standard	$4	$4	$4	$4	$4

NOTES: *weighted average

II. Gasoline Sulfur Regulations

EPA finalized a requirement for a refinery 30 ppm average sulfur level on an annual basis beginning in 2005. However, refiners would be given the flexibility to gain credits through the introduction of low sulfur gasoline as early as 2000 and to average, bank, and trade sulfur reduction. An 80 ppm per gallon cap is established beginning in 2006 as shown in Table 9 below.

Small refiners, defined as companies employing no more than 1500 employees corporate-wide on average during 1998 and with a corporate crude capacity less than or equal to 155,000 barrels per calendar day in 1999, are allowed to meet less stringent interim requirements in 2004-2007. Also, refiners in Alaska, Idaho, Montana, North Dakota, Wyoming, Utah, Colorado, and New Mexico may comply with less stringent sulfur limits during 2004-2006.

Table 9
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.

III. Rulemaking Information

The Preamble describing EPA's Tier 2 standards and the gasoline sulfur rule, as well as the final regulatory language and support documents can be found on the Internet at EPA's web cite at: www.epa.gov/oms/tr2home.htm.