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401 M Street, SW
Washington, DC 20460

To Whom It May Concern:

On behalf of the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO), we are pleased to provide comments on the U.S. Environmental Protection Agency's (EPA's) proposed Tier 2 motor vehicle emission standards and gasoline sulfur control requirements, as published in the *Federal Register* on May 13, 1999 (69 FR 26004).

STAPPA and ALAPCO commend EPA for its leadership, not only in issuing the Tier 2 and gasoline sulfur proposal, but also for developing such a strong and comprehensive package. We further commend EPA for responsibly taking full advantage of the opportunity to efficiently and cost-effectively reduce a wide variety of emissions, for pursuing a systems approach that addresses both fuels and tailpipe emissions and for engaging in such a thorough, thoughtful and inclusive process to craft this proposal.

We are especially pleased that the proposed Tier 2 and gasoline sulfur programs directly reflect almost every key recommendation made by STAPPA and ALAPCO over the past two years. These programs, which will define our ability to control emissions from cars and light-duty trucks for the next 15 years or so, are of vital importance to our memberships. For this reason, in October 1997 and April 1998, our associations adopted, with overwhelming support, resolutions calling for stringent low-sulfur gasoline and Tier 2 programs (copies of both of these resolutions are attached). We have placed the highest priority on participating in the rule development process and are proud that EPA has concluded that the most appropriate programs so closely mirror those for which we have advocated.

As the officials with primary responsibility for achieving and maintaining clean, healthful air across the country, state and local air agencies are keenly aware of the need to aggressively pursue emission reductions from all sectors that contribute to our nation's air quality problems. We believe the potential air quality benefits to result from cutting emissions from light-duty vehicles (LDVs) and light-duty trucks (LDTs) and reducing sulfur in gasoline, as the agency has proposed, are tremendous. These proposed programs will allow us to make significant strides in our efforts to deliver and sustain clean air by resulting in or facilitating substantial and much-needed emission reductions across the country. These emission reductions will play a pivotal role in addressing an array of air quality problems that continue to pose health and welfare risks nationwide.

While much of the debate surrounding the air quality need for Tier 2 and low-sulfur gasoline seems to have gravitated toward ozone, it is imperative that we not overlook the many other important air quality benefits of this proposal, to be realized by both nonattainment *and* attainment areas, east *and* west. While this proposal will, indeed, decrease emissions of hydrocarbons and NO_x, which, in turn, will lead to reduced levels of ambient ozone, it will also decrease particulate and carbon monoxide emissions, improve visibility, address acid rain problems and reduce greenhouse gases and toxic air pollution. In addition, the substantial reductions to occur from this proposal will further the objectives of pollution prevention. Additionally, the proposed programs will achieve these important air quality improvements in an extremely cost-effective manner. At approximately \$2,000 per ton of NO_x+VOC removed, as estimated by EPA, these programs are at least as cost effective as, if not more cost effective than, most other control measures available to us, and the dividends, as we have mentioned, are huge.

There are some components of the proposal with which we have concerns and we will offer recommendations to address these. Nonetheless, STAPPA and ALAPCO congratulate EPA for issuing a proposal that we believe provides a sound framework for environmentally and economically responsible Tier 2 and gasoline sulfur programs

PROPOSED TIER 2 MOTOR VEHICLE EMISSION STANDARDS

STAPPA and ALAPCO strongly support what we believe are the cornerstones of the proposed Tier 2 program. Specifically, we are pleased that the proposal:

Cost-effectively achieves real-world emission reductions from new LDVs and LDTs;

Reflects new and emerging vehicle and emission control technologies currently available and expected to be available in 2004 and beyond;

Applies to LDVs and LDTs up to 8,500 pounds, including sport utility vehicles (SUVs), pickup trucks and vans, beginning in 2004;

Subjects LDTs up to 8,500 pounds gross vehicle weight rating (GVWR) to the same emission standards as cars and lighter trucks and includes a corporate average NO_x standard for all affected vehicles;

Establishes fuel-neutral standards, applying the same emission standards irrespective of the type of fuel used to power a vehicle;

Includes a more stringent evaporative emissions standard; and

Extends the useful life of passenger cars to 120,000 miles.

These program components are right on target for a truly effective national motor vehicle emissions control program. We would like to elaborate on several of these points and also identify some areas of concern and related recommendations for improving the Tier 2 proposal.

Relative Stringency of LDV and LDT Standards

As illustrated below, by approximately 2005, the nationwide split in driving will be about equally divided between passenger cars and LDTs; this split will shift even more in the direction of LDTs thereafter. The perpetuation of more lenient emission (and fuel economy) standards not only allows this trend, but encourages it by placing relatively cleaner cars at a competitive disadvantage with light trucks. EPA must adopt the same principle as has been adopted by California: vehicles used for the same purpose, regardless of size, should be required to achieve the same emissions standards.

Vehicle Miles Traveled		
Year	VMT Split (%)	
	LDV	LDT
2000	57.0	43.0
2005	50.9	49.1
2007	49.4	50.6
2010	47.0	53.0
2015	45.2	54.8
2020	44.3	55.7

Uniform Application of Emission Standards Regardless of Fuel

While diesels represent a much smaller fraction of light-duty vehicles in the U.S. than in Europe or Japan, there is every indication that this will change in the future. Researchers for the Partnership for a New Generation of Vehicles (PNGV) believe highly fuel-efficient, direct-injection (DI) diesel engines, where the fuel is injected directly into each engine cylinder, show the greatest promise for near-term hybrids. According to the PNGV program, DI engines can achieve better mileage when combustion is triggered by highly compressing the air-fuel mixture so it self-ignites (i.e., compression ignition), instead of using spark plugs (i.e., spark ignition) at lower compression ratios. These compression-ignition, direct-injection (CIDI) engines become an especially attractive primary power source for hybrid-electric vehicles (HEVs) when operated with either reformulated fuels (for example, low-sulfur fuel now available in California) that help catalytic converters work better at cleaning up pollutants, or new fuels that produce almost no particulate.

In order to assure, therefore, that these highly efficient diesels achieve the full environmental potential for which researchers have stated they are striving, it is necessary that they be required to achieve the same emissions standards as gasoline-fueled vehicles. Perpetuation of the current relaxed NO_x and particulate standards for diesels will not only allow “dirty” diesels, but encourage them. This loophole should be closed and, again, the overriding principle should be that vehicles used for the same purpose, regardless of fuel, should be required to achieve the same emission standards. Further, diesel vehicles should be required to meet the same “off-cycle” limits for NO_x and PM as gasoline-fueled vehicles. Diesel engines used in LDVs and LDTs tend to be used in the same applications as their gasoline counterparts and, thus, they should meet the same standards.

Another factor to be considered is the growing body of data demonstrating that diesels without aftertreatment controls emit one to two orders of magnitude more “ultrafine” particles than today’s state-of-the-art gasoline-fueled vehicles. Therefore, the PM emissions standard, if set stringently enough to force the use of particulate filters, would have the additional advantage of lowering “ultrafine” PM, as well.

Today, diesels comprise less than one-half of one percent of all LDV/LDT sales. While this is a small fraction, the potential exists for diesels to gain a considerable market share in the future. All one need do is review the dramatic increase in recent years of diesel engine use in the lightest category of heavy-duty vehicles (8,500-10,000 pounds GVWR) to see the potential for significant diesel engine use in LDTs, and perhaps LDVs, in the future. Just ten years ago, diesels made up less than 10 percent of this class of vehicles. In 1998, this fraction approached 50 percent.

The potential impact of large-scale diesel use in the light-duty fleet underscores the need for the same standards to apply to diesels as for other vehicles. Given the health concerns associated with diesel PM emissions, it is prudent to address PM emissions from

diesel LDVs and LDTs while their numbers are relatively small. In this way the program can minimize the PM impact that would accompany significant growth in this market segment, while allowing manufacturers to incorporate low-emission technology into new light-duty diesel engine designs.

Corporate Average Tier 2 Standards

The current Tier 1 emission standards apply to each LDV or LDT separately. There is no flexibility to allow some vehicles to meet a more stringent standard and others to meet a less stringent standard, thus allowing manufacturers to comply with standards based on a fleet average. EPA has, however, established corporate average emission standards in other contexts (e.g., heavy-duty engine standards). The voluntary National Low-Emission Vehicle (NLEV) program uses a fleet average standard to help determine manufacturer compliance with the requirements. Also, compliance with the California Air Resources Board's (CARB's) Low-Emission Vehicle (LEV) and LEV II standards is accomplished on a corporate average basis.

The CARB program has demonstrated how a carefully defined program can stimulate the introduction of advanced technologies. However, the federal heavy-duty program, which provides complete freedom to the manufacturers to select any emissions levels (FELs), appears to encourage gaming and perhaps even cheating and has not stimulated the early introduction of advanced technologies. Therefore, it is recommended that any averaging program being considered limit flexibility by specifying a limited number of non-methane organic gas (NMOG), NO_x and PM emission standards (bins) to which individual vehicle models may be certified. We believe that California's decision to have four bins is appropriate; more than four bins increases the administrative difficulties. Certainly there should be no additional bins added.

Extended Useful Life and Other Options to Improve In-Use Performance

Section 202(i) of the CAA directs EPA to consider extending the useful lives of the LDV and LDT emission standards. As vehicles become more durable and last longer, it is necessary that their pollution controls also become more durable. Earlier evaluations have demonstrated that it is much more cost effective to design and build more durable emissions control systems than it is to repair and replace these systems in use. Therefore, EPA should extend the useful life requirements sufficiently to assure that most in-use vehicles under normal operation will be able to meet emissions standards over their entire actual lifetime. We believe that increasing the useful life of cars to 120,000 miles is a significant step in the right direction. However, a growing number of cars and other LDVs are lasting more than even this amount.

Based on the Tier 2 model, approximately 13 percent of light-duty NO_x and 11 percent of light-duty VOCs are produced between 100,000 and 120,000 miles. Additionally,

41 percent of light-duty NO_x and 59 percent of light-duty VOC are produced beyond 120,000 miles. Given the trend toward longer actual vehicle lives and increases in annual mileage, we believe that it is reasonable to propose an extension to the regulatory useful life requirements.

We support adoption of a provision to provide additional NO_x credit in the fleet average calculation for vehicles certified to a useful life of 150,000 miles. We agree that a manufacturer certifying an engine family to a 150,000-mile useful life should be allowed to incorporate those vehicles into its corporate NO_x average as if they were certified to a full useful life standard 0.85 times the applicable 120,000-mile NO_x standard. To use this option, the manufacturer would have to agree to 1) certify the engine family to the applicable 120,000-mile exhaust and evaporative standards at 150,000 miles for all pollutants, 2) warranty the vehicle in use and 3) increase the mileage on the single extra-high mileage in-use test vehicle from a minimum of 90,000 miles to a minimum of 105,000 miles.

Other Recommended Improvements

In addition to the recommendations provided above, STAPPA and ALAPCO also offer the following recommendations to address our concerns with respect to several provisions included in the proposal or raised for public comment that we believe could significantly undercut the Tier 2 program.

Timing

EPA proposes to allow larger SUVs, vans and trucks (from 6,000 to 8,500 pounds GVWR) until 2009 – ten years from today – to meet the Tier 2 standards. Given the significant and ever-growing share of the market comprised by these heavier light-duty trucks and the substantial impact their emissions have on our ability to achieve and maintain our clean air goals, we question the need for this additional time and recommend that the phase-in to the standards be final by 2007, when cars and lighter trucks are required to comply. California's LEV 2 program will be fully implemented by 2007 and EPA should do the same. STAPPA and ALAPCO believe this provides more than adequate lead time.

Technology Review

EPA seeks comment on whether to include a technology review of the Tier 2 standards, perhaps in the 2004 timeframe, before the standards for heavier LDTs take effect. Given that EPA is always at liberty to relax an existing standard – provided that the standard was not statutorily established, and these Tier 2 standards are not – and that there is substantial lead time provided in this proposal, we find the notion of a formal technology review to be inappropriate and unnecessary and we strongly urge that provisions for it not be included in the final rule.

Our chief concern is that by explicitly highlighting a specific technology review to take

place at a given time, EPA will be inviting manufacturers to divert some of their efforts away from developing the means with which to achieve the standards and toward showing why standards cannot be met. While our preference is for no technology review to be included in the final Tier 2 rule, if EPA concludes that a specific technology review is to be included in the final rule, it should be very narrowly defined and should clearly assure that the adopted standards automatically remain in effect unless EPA makes an affirmative finding that the standards cannot be met by a category of vehicles, rather than the other way around. In addition, EPA, and not an independent group, should conduct the technology review and make any final decisions. Further, any technology review should consider not only if standards cannot be achieved, but also if tighter standards are feasible.

Flexibility

Another area of concern is the degree of flexibility offered with respect to certain provisions of the proposal. We certainly agree with EPA that there should be some measure of flexibility included in the Tier 2 program and find some of the approaches provided for to be entirely appropriate. However, we are quite concerned with a few aspects of some of the proposed provisions.

With respect to the Averaging, Banking and Trading (ABT) program, we believe it is inappropriate to provide a year for manufacturers to make up for any credit shortfall. Participants in this program should be required to plan for such an event and may do so by, among other things, incorporating a buffer into their plan or building up credit to address a future potential shortfall. In any case, participants in the ABT program should be required to meet their targets on time. Further, credits earned under the ABT program should expire after a specified amount of time and, in interim years leading up to the expiration date, be discounted; we recommend that EPA adopt such features.

In addition, no ABT program should impede the technology-forcing nature of the program, nor should it interfere with emission reductions planned under other control programs or permit “double counting” of emission reductions from one program to the next.

Finally, STAPPA and ALAPCO also urge EPA to issue an annual report that details the performance of each manufacturer relative to the required standards. With multiple bins and vehicle categories, and a largely self-certification effort being introduced by CAP 2000, it is critically important that EPA commit the resources necessary to provide adequate information. The recent experience with heavy-duty engine defeat devices has demonstrated, once again, that it would be unwise and inappropriate to rely on industry to police itself.

Migration Toward Heavier LDTs

Regarding the applicability of the Tier 2 standards, given the continuing trend toward heavier LDTs over 8,500 pounds GVWR, we encourage EPA to consider applying the Tier 2 standards to those SUVs, pickup trucks and full-size vans weighing over 8,500 pounds GVWR, up to 10,000 pounds GVWR, used predominantly for personal transportation.

Existing regulations define an LDT to be any motor vehicle rated at 8,500 pounds GVWR or less with a curb weight of 6,000 pounds or less and a basic frontal area of 45 square feet or less and which is:

Designed primarily for purposes of transportation of property or is a derivation of such a vehicle;

Designed primarily for transportation of persons and has a capacity of more than 12 persons; or

Available with special features enabling off-street or off-highway operation and use.

For the heaviest LDTs, we are concerned that manufacturers may, in some cases, find it attractive to add GVWR capacity, curb weight or frontal area to their vehicles, such that they would no longer meet one or more of the criteria to be considered an LDT. The vehicles would then fall into the heavy-duty category and would be subject to less technologically challenging standards.

STAPPA and ALAPCO favor the development of reasonable restrictions to prevent this “gaming” of the LDT definition. The ideal restrictions would prevent migration of LDTs above the limiting criteria, but would not affect vehicles with legitimate needs to be outside, but close to, the LDT definition. Our objective is complicated by the fact that many LDTs currently have derivatives or corresponding models that are over 8,500 pounds GVWR.

In the longer term, the best way to address the vehicle migration issue is to implement standards for complete heavy-duty vehicles that have a stringency comparable to their heavy LDT (HLDT) counterparts. In the near future, we urge EPA to publish a proposal addressing emissions from gasoline-fueled heavy-duty engines and vehicles for 2004 and later model years. As part of that effort, we urge EPA to adopt chassis-based standards for complete vehicles between 10,000 and 14,000 lbs GVWR.

Hydrocarbon Shortfall

While the NO_x-driven approach proposed by EPA reduces overall NO_x emissions to a degree comparable to the California LEV II program, the agency’s proposal will result in a considerable shortfall in non-methane hydrocarbon (NMHC) emission reductions. This is important both because some areas of the country need significant additional hydrocarbon

control to attain and maintain the ozone air quality standards and all areas of the country need lower NMHCs to reduce toxic emissions exposure. We urge EPA to reduce or eliminate the shortfall relative to the California LEV II program by adopting some combination of the following approaches or other approaches that would achieve comparable results.

Evaporative HC Emission Standards — Evaporative HC emissions from Tier 1 and LEV vehicles exceed exhaust NMHC emissions in-use. (Evaporative HC emissions include running losses, hot soak emissions, diurnal emissions and resting losses.) It is, therefore, appropriate to tighten the current evaporative HC emission standards in the process of considering tighter Tier 2 exhaust emission standards.

Available technologies include a second charcoal canister to trap HC emissions not absorbed by the standard canister, bladder fuel tank systems, pressurized fuel tanks, pressurized vapor reservoir systems, insulated fuel tanks and improved seals for the onboard vapor recovery systems (refueling emission controls). A number of current vehicles have certification levels of evaporative emissions that equal less than one-fifth of the current emission standards.

Because of the contribution these hydrocarbons make to ozone formation and toxic exposures, EPA should require the most stringent evaporative controls that are feasible and cost effective. The proposal calls for about a 50-percent reduction compared to the 75-percent reduction in the California LEV II package. Since a 75-percent reduction has been found to be feasible by California, we urge EPA to adopt the same degree of control as CARB.

Reducing the Number of Bins — We note that to increase flexibility for vehicle manufacturers, EPA's proposal includes several bins in addition to those provided for under the California LEV II program. STAPPA and ALAPCO believe that the standards comprising these proposed additional bins are relatively weak. Specifically, we find the approach taken for bin 3, which includes a higher NMOG standard than bin 4, to be inappropriate. Further, we find bins 6 and 7 to be excessive in terms of their leniency.

In addition, if bin 5 were eliminated while retaining the 0.07 gram/mile NO_x standard, NMOG exhaust emissions would more closely approach those that could be achieved under LEV II.

Corporate Average NMOG Curve — Another alternative to lower HC emissions would be to add an NMOG curve to the NO_x curve so that manufacturers would need to produce and sell a mix of vehicles that could meet both the NO_x and NMOG curves.

Light-Duty Supplemental Federal Test Procedure Standards

Supplemental Federal Test Procedure (SFTP) standards require manufacturers to control emissions from vehicles when operated at high rates of speed and acceleration (the US06 test cycle) and when operated under high ambient temperatures with air conditioning loads (the SC03 test cycle). The existing light-duty SFTP requirements begin a three-year phase-in in model year 2000 for Tier 1 LDV/light LDTs (LLDTs). For HLDTs, SFTP requirements begin a similar phase-in in 2002. Intermediate and full useful life standards exist for all categories. SFTP standards do not apply to diesel-fueled Tier 1 LDT2s and HLDTs. The table below shows the full useful life federal SFTP requirements applicable to Tier 1 vehicles.

Full Useful Life Federal SFTP Standards Applicable to Tier 1 Vehicles

Vehicle Category	NMHC + NO _x (weighted g/mi) ^a	CO (g/mi) ^b		
		US06	SC03	Weighted
LDV/LDT1 (gasoline)	0.91	11.1	3.7	4.2
LDV/LDT1 (diesel)	2.07	11.1	--	4.2
LDT2	1.37	14.6	5.6	5.5
LDT3	1.44	16.9	6.4	6.4
LDT4	2.09	19.3	7.3	7.3

^aWeighting for NMHC+NO_x and optional weighting for CO is
 $0.35x(\text{FTP}) + 0.28x(\text{US06}) + 0.37x(\text{SC03})$.

^bCO standards are stand alone for US06 and SC03 with option for a weighted standard.

The NLEV program includes SFTP requirements for LDVs, LDT1s and LDT2s. These requirements impose the Tier 1 intermediate and full useful life SFTP standards on Tier 1 vehicles and Transitional Low-Emission Vehicles (TLEVs), but impose only 4,000-mile standards on LEVs and Ultra Low-Emission Vehicles (ULEVs).¹ NLEV SFTP standards for LEVs and ULEVs are shown in the table below. These standards do not provide for a weighted standard for NMHC+NO_x or for CO, but rather employ separate sets of standards for the US06 and SC03 tests. Also, while the NLEV SFTP standards apply to gasoline and diesel vehicles, they do not include a standard for diesel particulate.

¹ This disparity in useful lives arose because neither EPA nor CARB had full useful life SFTP standards for LEVs or ULEVs when the NLEV program was adopted. Since a major requirement of the NLEV program was harmony with California standards, EPA adopted the California SFTP standards in place for the NLEV time frame (2001 and later).

SFTP Standards for LEVs and ULEVs in the NLEV Program

	US06		SC03	
	NMHC+NOx (g/mi)	CO (g/mi)	NMHC+NOx (g/mi)	CO (g/mi)
LDV/LDT1	0.14	8.0	0.20	2.7
LDT2	0.25	10.5	0.27	3.5

We support EPA’s stated intention to substitute SFTP standards adjusted for intermediate and full useful life deterioration where there are currently only 4,000-mile standards.

Full useful life standards for Tier 2 vehicles are consistent with EPA’s mandate under the Clean Air Act. The 4,000-mile standards exist in the federal program only because they were adopted in the NLEV program — a voluntary program under which California requirements were adopted nationwide. The full and intermediate useful life SFTP standards STAPPA and ALAPCO are supporting are shown in the tables below. These standards would apply to all Tier 2 vehicles, including Tier 2 LDT3s and LDT4s.

**Proposed Full Useful Life Supplemental Emission Standards
(SFTP Standards) (g/mi)**

	US06	US06	SC03	SC03
	NMHC+NOx	CO	NMHC+NOx	CO
LDV/LDT1	0.2	11.1	0.26	4.2
LDT2	0.37	14.6	0.39	5.5
LDT3	0.53	16.9	0.44	6.4
LDT4	0.78	19.3	0.62	7.3

Proposed Intermediate Useful Life Supplemental Emission Standards

(SFTP Standards)(g/mi)

	USO6	USO6	SCO3	SCO3
	NMHC+NO_x	CO	NMHC+NO_x	CO
LDV/LDT1	0.16	9.0	0.22	3.0
LDT2	0.30	11.6	0.32	3.9
LDT3	0.45	11.6	0.36	3.9
LDT4	0.67	13.2	0.51	4.4

LDT3 and LDT4 SFTP standards do not currently apply to diesels. Further, the standards applicable to Tier 1 diesel LDVs and LDT1s are less stringent than gasoline standards and do not apply to the SCO3 cycle. We believe this is unfair and inconsistent with the fuel-neutral approach. Therefore, STAPPA and ALAPCO support applying the same principle we have advocated for other aspects of this program to the Tier 2 and interim SFTP standards. Consequently, Tier 2 and interim LDVs and LDTs with diesel or gasoline engines should comply with the same NMHC+NO_x and CO SFTP limits. Since, in recent consent decrees, heavy-duty engine manufacturers have agreed not to exceed emission levels 1.25 times the applicable exhaust standards (including PM standards) when engines are operated over a wide range of operating conditions, we believe it would be appropriate to establish a margin of 25 percent above the applicable FTP PM standard to serve as the SFTP standard.

Emissions Labels

With multiple bins and widely varying emissions levels, it is important that individual consumers have a means to distinguish between vehicles based on their emission standards. We believe that many individuals would prefer to purchase the lower-polluting models and could benefit from an approach that would help to identify such vehicles. Further, many state and local governments and other organizations may wish to stimulate the sale of lower-polluting vehicles through incentive schemes.

With such a plethora of vehicle types (cars and four categories of light trucks) and standards (as proposed, seven bins, interim standards, etc.), labeling could be very complex and difficult for the public to understand. Therefore, we recommend that EPA devise a scheme similar to California's Smog Index, to be applied consistently nationwide. We further suggest that EPA initiate a public education campaign related to vehicle labeling and note that the Mobile Sources Technical Review Subcommittee convened under the Federal Advisory Committee Act has adopted a resolution making a similar recommendation.

PROPOSED GASOLINE SULFUR CONTROL REQUIREMENTS

As with the Tier 2 program, STAPPA and ALAPCO also believe EPA has done a fine job in establishing the key parameters of the proposed low-sulfur gasoline program. EPA's proposal very appropriately and necessarily:

Establishes uniform, national, year-round standards to sharply reduce sulfur in gasoline;

Sets a gasoline sulfur standard of 30 parts per million (ppm) on average, to take effect in 2004, and includes a sulfur cap of 80 ppm;

Includes flexibilities to minimize the cost to and compliance burden on affected parties; and

Provides incentives for refiners to reduce sulfur levels prior to the 2004 effective date.

A STAPPA/ALAPCO analysis conducted last spring concluded that a national low-sulfur gasoline program of this scope will achieve overnight emission reductions that are equivalent to taking 54 million vehicles off the road. Further, throughout the debate surrounding gasoline sulfur, the issue of a national versus regional program has been paramount. We are gratified that EPA has proposed that the low-sulfur gasoline standards apply uniformly nationwide. This approach will forestall the very real and detrimental impacts of irreversible catalyst poisoning and will do so in a way that is both inexpensive and cost effective. It is absolutely essential that EPA preserve these provisions, as well as the proposed effective date of 2004.

Fuel sulfur impacts vehicle emissions in two basic ways. One is an immediate impact, which occurs within a few miles of driving. The other is a more lasting impact, ranging from 20 or more miles to potentially permanent. This lasting effect of sulfur on emissions is termed "irreversibility," referring to the fact that the adverse emission impact of high-sulfur fuel does not reverse when low-sulfur fuel is used.

The immediate impact of sulfur on emissions is substantial. Operation on typical conventional gasoline containing 330 ppm sulfur will increase exhaust VOC and NO_x emissions from LEV and Tier 2 vehicles (on average) by 40 percent and 150 percent, respectively, relative to their emissions with certification fuel containing roughly 30 ppm sulfur.

Some have argued that these effects are reversible and would not be a problem if low-sulfur fuel were available only in ozone nonattainment areas and higher-sulfur fuel were used elsewhere. First of all, there is no area of the country where these excess CO, HC and NO_x

emissions, as well as the SO₂, PM and PM precursor emissions directly related to sulfur in gasoline would not be a problem. Virtually every area of the country — areas with high ozone or PM, pristine areas, and even areas with concerns over individual toxic exposures — would benefit from lower vehicle emissions. Further, the available evidence indicates that catalysts do not fully recover from sulfur exposure. Therefore, if fuel standards are not implemented uniformly nationwide, vehicles with degraded emission controls from higher-sulfur fuel use would travel to areas with low-sulfur fuel and adversely impact air quality in those areas.

Sulfur sensitivity is temperature dependent. Sulfur adheres to the catalyst surface more thoroughly at lower catalyst temperatures (approximately 450 C to 500 C) than at higher temperatures. In fact, the sulfur sensitivity results from the numerous fleet studies appear to actually underestimate the sensitivity of sulfur on exhaust emissions, because the test cycles (FTP or LA4 cycles) used to saturate the catalyst with sulfur result in catalyst temperatures that are too high. Specifically, most vehicles achieve catalyst temperatures over the FTP that exceed 450 C, thus not allowing complete adsorption of sulfur to the catalyst surface, whereas real-world vehicle operation in metropolitan nonattainment areas quite frequently result in catalyst temperatures at or below 450 C.

A second concern about the current estimates of sulfur sensitivity is that all of the vehicles in the test programs used to develop projections of sulfur sensitivities were exposed to high-sulfur fuel only for a few miles of driving prior to emission testing. In addition to adsorbing onto the surface of the catalyst, sulfur can also penetrate into the precious metal layer and into the oxygen storage material, affecting the catalyst's ability to store oxygen — a critical function for NO_x control. This penetration may not have fully occurred during the very few miles of operation prior to emission testing on high-sulfur fuel. In an American Petroleum Institute sulfur reversibility test program, vehicles' sulfur sensitivity was measured after both short-term exposure to high-sulfur fuel and after 1,000-2,000 miles of driving with high-sulfur fuel. For the five vehicles tested, NMHC emission sensitivity was the same with both short-term and longer-term exposure to high-sulfur fuel. However, NO_x emission sensitivity was 25 to 50 percent higher after longer-term exposure to high-sulfur fuel when compared to short-term exposure. Thus, the above sulfur sensitivities could significantly underestimate the impact of sulfur on NO_x emissions for LEVs, ULEVs and Tier 2 vehicles.

Further, as noted by EPA, if sulfur reversibility was the only criteria involved in catalyst design, auto manufacturers could place their catalysts right up against the engine and design the onboard computer to vary the air-fuel ratio from rich to lean sufficiently to regenerate the catalyst after any temporary exposure to high-sulfur fuel. Engine exhaust temperatures are generally high enough at the exhaust manifold during typical driving to facilitate sulfur removal, but it is not certain that the catalyst will recover 100 percent of its performance in any case. The onboard computer is certainly capable of varying the air-fuel ratio significantly. However, other critical catalyst design criteria prevent the use of such simple measures. First, excessive temperatures can thermally damage the catalyst and reduce

its efficiency. Second, simultaneously high conversion efficiencies of HC, CO and NO_x require very tight air-fuel ratio control (minimal swings to either rich or lean conditions).

One additional factor affecting catalyst temperature is the upcoming implementation of EPA and California SFTP standards. The SFTP standards address emissions generated while the vehicle is driving aggressively (high speeds and high rates of acceleration) and while the air conditioning is turned on, both of which generate higher engine loads than exist during EPA's FTP test cycle. Manufacturers have historically designed their engines to run rich under high loads. The excess fuel decreases exhaust and catalyst temperature relative to an engine running at stoichiometry (just the right amount of air to burn the fuel). The SFTP standards will require that manufacturers reduce much of this high-load enrichment in order to reduce HC and CO emissions during these high loads. Therefore, all other factors being equal, exhaust and catalyst temperatures under extreme conditions will increase after implementation of the SFTP standards, which begin their phase-in in the 2001 model year. While these extreme conditions must be considered in the catalyst design process, their frequency in-use is not sufficient to be relied upon for sulfur removal and it is not certain that the catalyst will fully recover even under SFTP conditions. For example, some vehicle owners tow trailers up steep hills, while others do not. Further, while the SFTP standards may increase temperatures under some conditions, they will not necessarily increase sulfur removal capability for the general vehicle population.

Moving to the variation in air-fuel ratio, manufacturers have significantly enhanced their engines' and computers' abilities over the past few years specifically to avoid large swings in rich and lean operations. This ability to maintain tight control of the air-fuel ratio has increased catalyst efficiency significantly in the process. Designing the vehicle to have alternating rich-lean operation may improve the reversibility of sulfur effects, but would reduce catalyst efficiency and potentially prevent the achievement of both current and proposed Tier 2 exhaust emissions standards. As was the case with increasing catalyst temperature, it would be counter-productive to reverse this progress in overall emission control just to enhance the sulfur reversibility of catalyst systems.

Thus, the two changes in emission control design that some suggest should be used to reverse the detrimental impacts of sulfur on catalyst performance — hotter catalyst temperatures and variable air-fuel ratios — both run counter to other design criteria aimed at achieving stringent emission standards in-use over the full useful life of the vehicle. Therefore, STAPPA and ALAPCO believe that the full lifetime control should not be placed in jeopardy in an effort to accommodate high levels of sulfur that will also cause other unnecessary emissions problems.

Recommended Improvements

As we indicated regarding the Tier 2 standards, while we are extremely pleased with the framework and key elements of the gasoline sulfur proposal, there are several provisions that are of considerable concern to us.

Leniency of the Interim Cap

First, we strongly support the 80-ppm cap on gasoline sulfur, but believe that EPA's proposal to phase in this cap is excessive. While we agree that it may be appropriate to allow refiners that participate in the proposed ABT program with a few additional years (until 2006) to meet the 80-ppm cap, we find the 300-ppm interim cap proposed by EPA to be far too high. Instead, we suggest that for those that participate in the ABT program, the interim cap in 2004 be lower than 300 ppm and in 2005 lower still. Further, for those that do not participate in the ABT program, we find any interim cap to be inappropriate and urge that the 80-ppm cap apply beginning in 2004.

Streamlining New Source Review For Refinery Modifications

STAPPA and ALAPCO would like to acknowledge an issue that we know is of concern to some — that of the timely issuance by state and local agencies of permits to petroleum refineries so that the modifications necessary to produce low-sulfur gasoline can be made. We hope we have made clear the fact that state and local air agencies are extremely supportive of the national low-sulfur gasoline program. We want and need this program and will make the issuance of permits to ensure the timely availability of fuel a top priority.

When California began Phase 2 reformulated gasoline, the issuance of permits did not disrupt implementation of that program and we do not expect the issuance of permits to disrupt implementation of the federal program. We support means, such as model permits, increased technical assistance and stakeholder processes, among others, to facilitate permitting, and are committed to working with all affected parties to expedite the processing and issuance of permits so that the program will take effect and we can reap its clean air benefits as scheduled.

CONCLUSIONS

In conclusion, STAPPA and ALAPCO applaud EPA for seizing the opportunity to take a huge step forward in achieving much cleaner air. We commend your thorough process, your conscientious inclusion of all stakeholders and consideration of their views and, most of all, your leadership in proposing fundamentally strong programs that are technologically feasible, cost effective and environmentally responsible. We urge that as you engage in efforts to develop a final rule for Tier 2 motor vehicle standards and low-sulfur gasoline you preserve undiminished the key elements that we have identified and refine those aspects of the proposal that could undermine the tremendous potential of these programs. Finally, we

stress the need for the agency to act in a timely manner so that these important programs will begin in the time frames identified in the proposal.

Sincerely,

John Elston
STAPPA Chair
Mobile Sources and Fuels Committee

Richard H. Baldwin
ALAPCO Chair
Mobile Sources and Fuels Committee