American Rental Association

John W. McClelland, Ph.D.
Vice President, Government Affairs

1101 Vermont Ave. NW, Suite 400
Washington, D.C. 20005
202/289-4460 Phone
202/289-4461 Fax
John.McClelland@ararental.org

December 3, 2008

The Honorable Mary D. Nichols
Chairman
Air Resources Board
1001 I Street
Box 2815
Sacremanto, CA 95812

Dear Chairman Nichols:

Attached are detailed comments from the American Rental Association (ARA) on the pending regulation of On-Road Heavy-Duty Diesel Trucks. The ARA represents more than 275 rental businesses in California at more than 500 locations as well as over 100 associate members who manufacture equipment for the rental industry. The Rental industry generated more than $4.25 billion in revenues in 2007 creating more than 77,000 jobs for Californians.

Over the past four years ARA has been deeply involved in the development and implementation of amendments to the Portable Equipment Registration Program (PERP), the In-Use Off-Road Mobile Diesel regulations, and the On-Road Heavy-Duty Diesel Truck regulations. In general, the staff of the Air Resources Board has been very accessible and responsive to our comments and concerns. However, in our work on the current regulation that has not always been the case. You will see in our detailed comments prepared by myself and Dr. Michael Graboski that we have real issues with the structure and analysis ARB staff has applied to this proposed regulation. Furthermore, Dr. Graboski has provided many detailed enquiries which have either been addressed in a cursory manner or not addressed at all.

ARA believes that the costs of this proposed regulation will fall disproportionately on fleets of small diesel trucks which have low mileage and few emissions. Many of these trucks are used by small businesses that may not be able to afford expensive retrofit packages for trucks that are generally replaced on average every ten years. The bifurcation of the truck fleet proposed by ARB staff creates an unequal playing field that allows large trucks that drive many miles in California to pay less per ton of avoided emissions than other trucks that have engines certified to the same emissions standards. The result is an unfair and biased distribution of costs and benefits among the regulated parties. We believe these costs and benefits should be more equal and our comments make several suggestions on how that equality can be achieved.

We appreciate the opportunity to share our comments with you and the Members of the ARB, and we look forward to answering any questions you may have.

Sincerely,

John W. McClelland

Comments of the American Rental Association

on

On-Road Draft Final Rule

John W. McClelland Ph.D.
ARA Vice President Government Affairs
1101 Vermont Ave. N.W., Suite 400
Washington, DC 20005

and

Michael S. Graboski Ph.D.

December 2008

American Rental Association

Comment on On-Road Draft Final Rule

The segmenting of the diesel truck fleet into medium-heavy duty diesel (MHD) and heavy-heavy duty diesel (HHD) parts for regulatory purposes is arbitrary. This segmentation could be justified because many HHD trucks are interstate vehicles traveling many freeway miles per trip while many MHD trucks are used for more local purposes, traveling shorter distances per trip. The over-the-road trucks accumulate many miles per year and the emission factors are higher due to deterioration. But a significant portion of the HHD fleet is single-unit trucks like dump trucks, concrete trucks and trash-hauling trucks with drive cycles that generate lower annual miles per truck similar to the MHD fleet. The division between HHD and MHD lessens the distinction between high use HHD tractors and MHD single unit trucks because of the inclusion of single unit trucks in the HHD fleet. Yet, both fleets are fitted with engines that meet the same emission standards for a given model year.

The MHD fleet is a less significant contributor to the 2008 diesel truck emission inventory. The NO_X and PM emissions from the entire MHD fleet are about 15% of the total NO_X and PM inventories attributable to on-road diesel trucks. The average California registered HHD tractor-trailer travels 55,000 miles per year in California compared to 29,000 miles for the average in-State single unit HHD truck and 23,400 miles for the average MHD truck. The average odometer value of the CA registered tractor-trailer HHD fleet is 696,000 miles compared to 339,000 miles for the HHD-SU fleet and 207,000 for the MHDD fleet. The in-state HHD tractor-trailer fleet is 8 years old compared to 8 years for the MHD fleet. The HHD-SU fleet is 9 years old.

Certain trucks have been regulated less severely or have been totally exempted even though they are higher emitters than MHD vehicles. HHD Drayage trucks travel 49,000 miles per year, are 12 years old and have accumulated 840,000 miles in their lifetime. Heavy agricultural trucks are 17-years old, travel 26,700 miles per year and have accumulated 601,000 lifetime miles.

Limited Mileage MHD Vehicles

Lower use vehicles are penalized in the rule while higher use more polluting vehicles receive a benefit. Greater emissions reductions might be achieved by accounting for age and use in the rule.

In the rule, there are definitions for low mileage and limited mileage agricultural vehicles. A limited mileage vehicle can have the designation until ***2017***

- if it is 15-years old and if it operates fewer than 15,000 miles
- if it is between 6 and 15 years is operated less than 20,000 miles or is less than 5 years old operates less than 25,000 miles.

- Low mileage vehicles operate fewer than 10,000 miles per year and can maintain that status until 2023. These vehicles are exempt from all NO_X and PM provisions until their designated year.

We estimate, the portion of the MHD fleet traveling 10,000 miles per year or less produce about 1% of the 2008 NO_X and PM heavy truck inventory and less than 2% at 15,000 miles.

Many medium heavy-duty vehicles are used relatively little. Most rental trucks are 26,000 pounds and under so that a commercial driver's license is not required to operate the vehicles. These vehicles are used for non-commercial local trips that might involve moving or home repair. In the rental fleet, the average age of vehicles is 6.5 years and the annual average miles accrued is 8,000. 86% of the fleet is 10-years old or less and is more or less uniformly distributed with respect to age. 95% of the fleet is less than 16-years old. This supports a fleet model where the majority of the fleet is being turned over completely every 10-years and a small number of specialty vehicles are held for a much longer time or alternately that a small portion of the fleet was purchased used. For the rental fleet, the average fleet odometer for the 10-year old fleet is 48,196 miles. For the complete rental fleet, which includes delivery trucks as well as rental trucks the median odometer is 44,971 miles and the average odometer is 67,414 miles. In our survey sample, 68% of the rental vehicles accumulated 10000 MPY or less, 83% accumulated 12500 MPY or less and 88% accumulated 15000 MPY or less. These values confirm the consistent low use nature of the rental fleet.

The 10-year portion of the fleet would be in averaging compliance naturally by 2017 as a result of rollover. In fact, this part of the fleet would always be in NO_X compliance but would be out of PM compliance for 2013 through 2015. Similarly, the fleet fails BACT and percentage BACT. Thus, the rule would force rental truck fleets to add VDECS to vehicles that they intended to turnover in a few years anyway. Since the normal turnover of this fleet always provides considerable NO_X averaging room, requiring filters could actually delay their turnover for cost recovery, resulting in increased NO_X emissions in order to reduce PM.

Table 1
Fleet Performance for 10-MY Uniform Distribution
Using Averaging

Year, January 1	NOX Target	NOX Index	PM Target	PM Index
2011		6.37	0.38	0.25
2012		5.03	0.29	0.21
2013	8.5	3.69	0.171	0.17
2014	5.8	3.10	0.06	0.13
2015	5.8	2.51	0.06	0.10
2016	4.6	1.92	0.06	0.06
2017	4.0	1.60	0.06	0.06
2018	4.0	1.28	0.06	0.06

Deterioration of emissions with vehicle use is real but ignored in the rule. The emission factors, in reality, are functions of the odometer reading. Fleet data used by ARB (VIUS data) shows that annual miles and odometer readings are related, and low use vehicles have low odometer readings. Using Table 17 in appendix "G" from the Staff Report for this rule (Staff Report), the PM emission factors at 207,000-mile odometer (MHD average) and 48,000-mile odometer (10-year rental fleet average) are summarized. This calculation points out how low use vehicles in general are penalized by the rule and high use vehicles benefit from the rule. Compliance costs are disproportionately shifted to low use fleets that do not produce as much emissions. In reality, the low use fleet modeled in Table 2 produces 10% less NO_X and 35% less particulate due to deterioration compared to the average fleet based on the same model year engine emission factors only without any adjustment for mileage.

Table 2

NO_X and PM Emission Factors at two Odometer Readings for MHD Vehicles- Table 17 Appendix G

MY	207,000-Miles	48,000-Miles	Ratio
		NO_X	
1990	16.3	15.6	0.96
1993	12.6	11.8	0.93
2005	8.9	7.7	0.86
		PM	
1990	1.753	1.213	0.69
1993	1.11	0.695	0.63
2005	0.386	0.258	0.67

This concept can be implemented in a number of ways so that low use fleets of MHD vehicles do not pay significantly higher compliance costs relative to other fleets by:

- Limited use exemption patterned after Ag Vehicle exemption
- Adding annual miles traveled into the averaging equation
- Adding annual miles and odometer reading into averaging

While adding annual miles and odometer into the averaging model would increase the complexity, it should be emissions neutral if the rule is based upon the proper average vehicle.

Low Use Interstate Trucks

Emission benefits are being given away for “low use” interstate trucks. We believe that providing low mileage exemptions for trucks whose primary business is interstate is not warranted. In fact, it is hard to envision IRP trucks that are economically viable that travel under 7500 miles per year. Such a finding should not violate the spirit of Interstate Commerce Clause because local trucks like most MHD and SU-HHD trucks do not compete with interstate or even in-state motor freight carriers.

Equity for Cost of Compliance:

By a number of measures this rule is not equitable in apportioning of costs. The cost of controlling emissions from the MHD fleet is much higher than for the HHD fleet. The result is an unfair burden on owners and operators of smaller trucks. ARA recommends that Staff make adjustments in the regulation that equalize the cost of compliances measured by dollars per ton of emissions between MHD and HHD fleets while meeting the regulatory reduction requirements established by the Board.

<u>The proposed rule does not consider the emission level per vehicle.</u> The fewer the emissions, the greater the cost of emission control per unit. Table 3 shows that medium duty trucks are the lowest emitters per class and yet the regulation targets these with vigor equal to that for the HHD-TT (in-state tractor trailer) fleet. The average truck in the HHD-TT fleet drives 2.5 times as many miles per year and emits 2 times as much per mile on average compared to the MHD truck. Thus, the emissions per year for a typical HHD-TT are five times that of a typical MHD truck.

Table 3
Comparative Emissions

		2008 NO_X Data	
Fleet	Count	Tons/day	Tons/Truck/Yr
HHD-IRP	60,263	139.6	0.85
HHD-TT	63,684	194.1	1.11
HHD_SU	43,275	57.8	0.49
HHD_Drayage	21,650	70	1.18
HHD_Ag	11,998	17.3	0.53
MHD-In-state	198,525	125	0.23

Table 11 in Appendix J of the Staff Report provides cost information. These are summarized in Table 4. The HHD low mileage fleet cost is adjusted to only include In-State HHD TT and in-state single unit truck (SU) vehicles. The lifetime cost for each Hi-Miles portion of the fleets is about $1 billion. The average cost per HHD vehicle is $13,977 compared to$ 5,798 for the MHD vehicle. The expenditure for tons from HHD vehicles buys 3.3 times as many tons of NO_X and 2.87 times as much particulate in 2014 compared to MHD vehicles (table 39 appendix G of the Staff Report).

Table 4
Emission Compliance Cost

Fleet	Total Compliance Cost	Annual Tons in 2014	
		NO_X	PM
Instate-MHD-Hi Miles	$ 964,000,000	24.87	2.00
Instate-MHD-Low Miles	$ 122,000,000	0	0.10
Instate HHD-Hi-Miles	$1,154,000,000	82.50	5.73
Instate HHD–Low Miles	$ 127,000,000	0	0.22

ARB defines Low miles vehicles as under 7,500 for HHD vehicles and under 5,000 miles for MHD vehicles. These vehicles must be fitted with filters. For MHD vehicles the compliance cost per VDECS is $3,780 while for HHD vehicles the cost is $5,495 per vehicle (table 11 Appendix J of the Staff Report). The cost per allowed mile is approximately the same but the particulate reduction is 2.2 times more for HHD vehicles.

Table 4 shows the cost of controls and emission inventory impacted for low mileage fleets. Our analysis of emissions as a function of miles for the MHD fleet is shown for 5000, 7500, and 10000 miles. We estimate that both fleets produce nearly identical emissions amounts at 7,500 miles. The MHD fleet costs increase substantially when increasing mileage because of the need to include controls for NO_X and PM on the additional vehicles. We believe that simply flipping the mileage allowed for HHD and MHD fleets would provide the same emission benefits at the same or reduced cost. Furthermore, we do not believe that ARB could justify the cost of a filter system for these low mileage vehicles.

Table 4 Cost of Compliance for Low Mile Fleets

	Miles/year			
	5,000	7500	10000	Total
HHD		2008 Inventory	(Pre –control)	
NOX, TPD		5.69		
PM, TPD		0.29		
Vehicle Count		21001		
Compliance $		$115.40		
MHD				
NOX, TPD	3.29	5.87	12.92	125
PM, TPD	0.16	0.28	0.60	4.6
Vehicle Count	32,264	43,427	50,925	198,525
Compliance Cost MM $	$ 122	$187	$230	$1,086
Relative Compliance Cost		3.7	2.0	1.0

For the MHD fleet, we calculated the approximate average cost of emissions controls for limited mileage vehicles. We estimate that at 10,000 miles per year, the cost per tons is almost 2 times that for the whole MHD fleet.

Apportioning Cost:

ARB Staff has used a definition of cost effectiveness as $/avoided tons of emissions. ARB has found that this rule is overall “cost effective” compared to previous regulations. This does not mean that costs and benefits are distributed equitably within the rule.

For ARA’s analysis, the applicable HHD fleet is HH-out of state, HH-CaIRP, HH-Tractor and HH-Single unit vehicles. The applicable MHD fleet is MH-In-state and MH-Interstate vehicles. Drayage vehicles and utility vehicles are covered by other rules. Ag, PTO and buses were not considered for this estimate.

ARB separated the fleet into MHD and HHD categories, and then established costs and emissions benefits related to these two segments. They calculated the total cost of the rule and the total benefits from the rule.

Total Regulatory Cost and 2008 Inventory

Table 5 shows the costs assigned to the two fleet segments and the pool of emissions from which reductions can be achieved. These data were extracted from table 26 of Appendix “G” and table 11 of Appendix “J” of the Staff Report.

Table 5
Total Regulatory Costs and 2008 Inventory

Fleet	Total $,MM	2008 NO_X Pool, TPD	2008 PM Pool TPD	2008 Effective NO_X[1]	Relative $/Inventory
MHDD	**$ 1,132**	**126.0**	**4.60**	**250.2**	**2.09]**
HHDD	**$ 2,671**	**613.4**	**23.0**	**1234.4**	**1.00**

In Carl Moyer, for example, ARB combines NO_X and PM to a single “Effective NO_X” emission. ARA used a factor of 27 tons of PM equal one ton of NO_X. This simplification provides a measure of total PM as primary and secondary PM. The ratio of HH/MH effective emissions is 4.9.

The regulatory cost assigned to the medium heavy-duty fleet per unit of inventory is about twice that per unit of inventory for the heavy-heavy duty fleet.

This is a result of applying the definition of NO_X and PM BACT to all vehicles regardless of their annual use and emission factors except for certain exempt vehicles generating a diminimus amount of emissions. HHD trucks drive farther and emit more per mile than MHD trucks. The daily truck VMT for the HHD fleet is 38.25 million miles. The corresponding VMT for the MHDD fleet is 12.85 million miles. The ratio of emission factors from the proposed rule is about 1.7 HHD/1 MHD. Based on the VMT and emission factor ratio, we estimate the HHD fleet produces 5.1 times the emissions of the MHD fleet, a result in agreement with the effective inventory based upon tabulated data from Appendix G of the Staff Report. The reason for the relatively high cost per unit of inventory compared to the HHD fleet is that the MHD fleet consists of more vehicles generating considerably fewer daily miles traveled and hence emissions per vehicle.

Cost recovery may be more problematic for MHD fleets because of the lower VMT compared to that for HHD fleets.

[1] Assumes 1 ton of PM equals 27 ton NO_X.

Estimate of Fleet Cost effectiveness:

It is not possible for ARA to make an *exact* calculation for the MHD and HHD fleets because of the rather limited emissions and cost data presented in Appendix G and J of the Staff Report.

ARA made a *relative* estimate of the total regulatory cost/benefit ratio as follows.

1. The individual NO_X and PM emissions benefits were calculated from the applicable HHD and MHD sub fleets in 2014 and 2020 from tables 34 and 35 in appendix G of the Staff Report. These sub fleets comprised the regulatory costs in Table 5.
2. The "Effective NO_X" benefits were calculated for 2014 and 2020.
3. The benefits were used to develop a linear equation for 'Effective NOX" benefits with respect to time for each fleet. This linear model was integrated between 2010 and 2023 to obtain the cumulative benefits for the medium-heavy and heavy-heavy fleets.
4. The total regulatory costs for each fleet were determined from Table 11 in Appendix J of the Staff Report and are shown here in Table 5.
5. The Cost per ton of avoided emissions was estimated by dividing the totals in (4) by the totals in (3).

Table 6
Emissions Benefits Tons/day (Items 1& 2)

	2014			2020		
	NO_X	PM	Effective NO_X	NO_X	PM	Effective NO_X
HH-Out	8.1	2	62.1	2.7	0.2	8.1
HH-CaIRP	9.9	1.8	58.5	4	0.3	12.1
HH-Tractor	51.7	4.8	181.3	36	2.4	100.8
HH-Single-Unit	20.4	1.1	50.1	13.8	0.7	32.7
Heavy-Heavy-Total	90.1	9.7	352.0	56.5	3.6	153.7
MH-Instate	24.9	2.1	81.6	13.9	0.9	38.2
MH-Interstate	0.1	0	0.1	0	0	0
Medium-Heavy-Total	25	2.1	81.7	13.9	0.9	38.2

Table 7
Linear Fit of Emissions Benefits (Item 3)

			Integrated Between 2010 and 2023	
	Slope	Intercept	Ton-years/Day[2]	Tons[3]
MHD	-7.25	14,683	826	301,663
HHD	-33.05	66,915	3,502	1,278,184

[2] The total emissions in Ton-years/day = Slope*(2023^2 –2010^2)/2+Intercept*(2023-2010)
[3] Tons = ton-years/day*365days/year

The estimated cumulative emissions benefits for the HHDD fleet are 4.24 times those obtained from the MHDD fleet. *Staff has the complete data set and could come up with the exact totals.*

Table 8 compares the cost effectiveness determined by this method for each fleet. The estimates in Table 8 and Table 5 are consistent.

Table 8
Approximate Cost Effectiveness by Fleet

	$/ton
HHD	$ 2,090
MHD	$ 3,753
Ratio, MH/HH	1.8

The regulation imposes 1.8 times more cost per ton of effective NO_X (NO_X+PM *27) removal from the MHDD fleet as from the HHD fleet. Since there are twice as many small MHD fleets compared to small HHD fleets, the higher cost per ton falls disproportionately on smaller MHD fleet owners.

Drayage trucks:

The existing drayage truck rule is lax in comparison to the on-road rule with respect to NO_X control.

ARB has passed a separate regulation for drayage trucks that is unfair to the on-road fleet. Drayage trucks produce 70% of the emissions of the entire MHD fleet with 10% of the vehicle count. By January 1, 2010, drayage trucks must only be 1994 MY or newer and if older than 2003 have a PM VDECS. Beginning January 1, 2014 they must meet 2007 standards and not the BACT requirement of a 2010 vehicle.

Not including these vehicles in the rule equally results in lost tons and shifts costs to other segments of the fleets.

Fleet Inventory Issues:

The data in the staff report and particularly Appendix G and J of the Staff Report are inadequate for analyzing the rule. ARA was unable to closely reproduce ARB's inventory and emission factors or to rationalize differences. We provide our analysis in the following section.

In January, we provided an extensive comment regarding the issue of MHD versus HHD vehicles that generated no response from Staff. That analysis presented a fairly good picture of the relative inventories, relative benefits and relative cost effectiveness for each fleet.

In order to analyze this draft final rule, we made requests for data and information in August and October. Staff was again unresponsive. Thus we undertook the task of analyzing the available data for MHD and HHD vehicles to attempt to understand the assumptions and calculations made by Staff.

2008 Fleet Analysis:

ARA examined the inventories from MHD single unit diesel trucks as a function of annual accumulated miles based upon the VIUS database. This database was relied upon by ARB to characterize the MHD fleet. We were able to reproduce the key characteristics for this fleet as detailed in Appendix G by ARB but not the emission factors used.

Emission Factors:

ARB has provided emission factors for the MHD and HHD fleets. The HHD data are from Zhou[4] while the MHD data are reported in Appendix G of the Staff Report. In estimating emissions, we assumed that ARB's fleet specific inventory emissions scale with these emission factors in each weight group through VMT. This means that multipliers for speed adjustments, idle time etc is a fixed proportional adjustments to the basis emission factors.

Databases:

ARB used a number of data sources, with the Federal 2002 FWHA database, VIUS, playing a prominent role, especially for the MHD fleet. In our analysis, we assume that the sample is random and sufficiently large so it fairly accurately characterizes the important qualities of the California owned fleet from a vehicle characterization perspective. It is well understood that the emissions from a vehicle, the emission factor, depend primarily on engine model year, vehicle characteristics (size, shape, transmission), operating weight, type of driving (local or freeway for example), and tampering and malmaintenance related to the vehicle. We described above our approach to estimating fleet emissions.

Because VIUS is a mail back survey, it captures primarily California owned or based vehicles. ARB has found that there is very little interstate MHD traffic. Thus, VIUS should represent the MHD fleet well. Indeed, ARB lists VIUS as its primary data source. VIUS, however, would not properly capture interstate trucking for trucks originating outside California. It would also not capture the portion of California VMT for California interstate trucks. ARB used IRP and IFTA data to develop its interstate truck populations. Details related to these data and a reference are not provided in Appendix G ; these data may have been collected from a proprietary database. A study conducted by U.C. Davis that found considerably less interstate traffic and an older interstate fleet seems not to have been used by ARB[5].

We sorted VIUS to include the subset of California and diesel vehicles only.

ARB apparently used DMV data or other data to estimate the total size and distribution of ages of the MHD fleet.

---

[4] Zhou, L., "Revision of Heavy Duty Diesel Truck Emission Factors and Speed Correction Factors", ARB, 2006.

[5] Lutsey, N., "Assessment of Out-of-State Heavy-Duty Truck Activity Trends in California", FINAL REPORT to California Air Resources Board, Contract #04-328, March 14, 2008

ARB MHD Fleet Characterization:

Appendix G of the Staff Report provides characterization data for the fleet and emission inventory estimates for the two emissions of interest, NO_X and PM, for the on-road regulation.

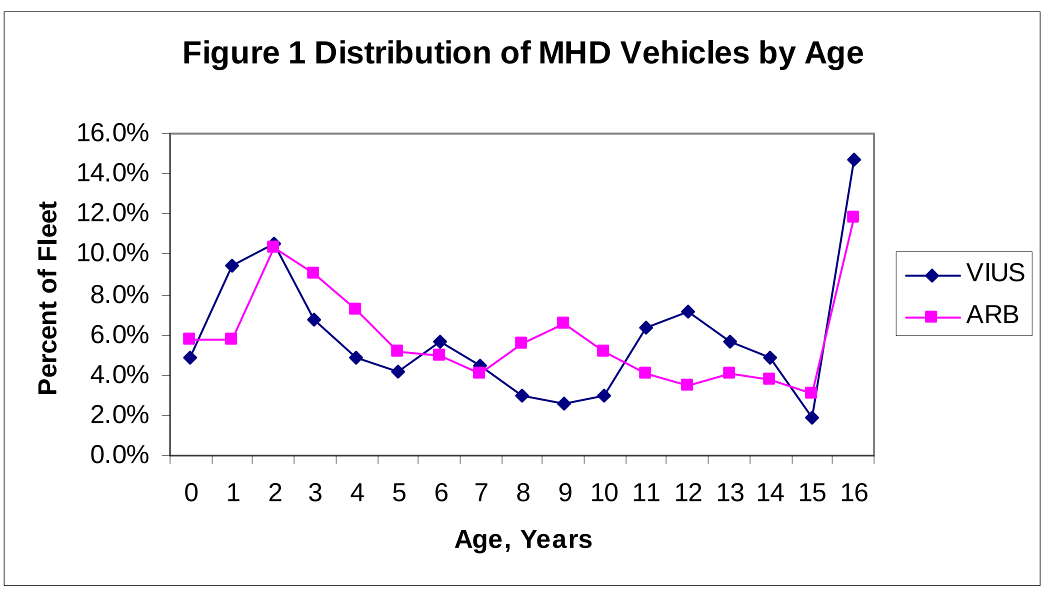
GVWR Groups:

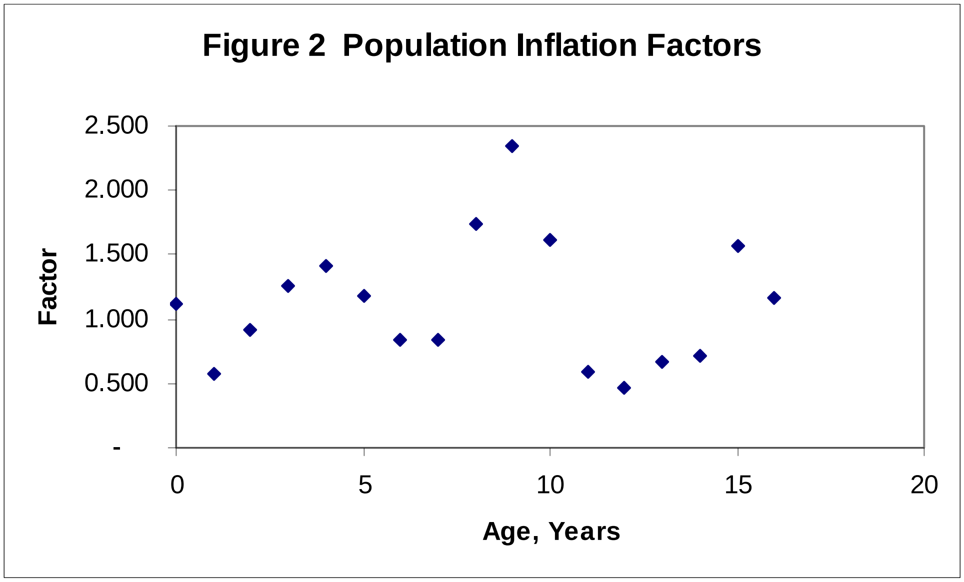
The VIUS data set allows vehicles to be grouped into 15 GVWR groups. Group 5 through 8 covers the ARB Medium-Heavy duty (MHD) weight range of 14,001 to 33,000 pounds. Groups 9 through 15 cover the Heavy-Heavy duty weight range of more than 33,000 pounds.

ARA sorted the California VIUS dataset into four groups for MHD single unit trucks, one group for medium heavy-duty tractor-trailers, seven groups for HHD single unit trucks and seven groups for HHD tractor-trailer trucks.

VIUS also provided inflators to correct the sample for fleet population and annual mileage. We examined averages based upon fleet counts and fleets averaged using the inflation factors. Because the weight groups of the MHD fleet had similar properties, the group characterizations were very similar. Since the inflation factors adjusted for fleet growth between 2002 and 2008 (3.1% growth assumed per Appendix G of the Staff Report) did not closely match either the MHD vehicle count or total VMT in 2008, we used sample count to characterize the fleet.

Sample count does not reproduce the population-age distribution in figure F of Appendix G of the Staff Report. We took data from Figure 7 to generate vehicle count inflation factors for the MHD fleet without consideration of MHD GVWR grouping. Figure 1 compares the population distributions. Figure 2 shows the age adjustment factors, which are population ratios. Since VIUS considers all vehicles older than 16 years as a single group, the ARB distribution was used to find the average age of that group. That average was used in fleet averaging calculations where the VMT inflation factors were used.





MHD Fleet:

The medium heavy-duty fleet general characteristics based upon uninflated sample count from VIUS are given in Table 9.

Table 9

Properties of MHD Fleet Sample[6]

Type	GVWR	Count	MT-WT	Loaded-Wt	%-Empty	Avg-Weight	Avg-Miles	AVG-Odometer	AVG-Age[7]
SU	14,001-16,000	58	10,747	14,981	23.11	14,002	20,733	132,806	5.6
SU	16,001-19,500	32	13,064	17,981	16.78	17,156	17,397	193,795	8.5
SU	19,501-26,000	96	15,500	22,866	20.24	21,375	22,593	183,307	7.4
SU	26,001-33,000	61	19,267	29,876	26.25	27,091	18,605	214,270	9.4
TT	26,001-33,000	20	21,050	30,099	24.81	27,854	28,371	492,447	11.7
	Total Sample	267	15,452	22,711	22.17	21,059	21,088	203,824	7.9
	Single Unit Only	247	14,998	22,113	21.95	20,551	20,498	180,454	7.6
	Less than 26,001	186	13,599	19,567	20.54	18,341	21,119	169,364	7.1

About 93% of the fleet is made up of single unit or straight trucks. Only 5% of the single unit trucks in the 26,001-33,000 GVWR group pull equipment trailers or dump trailers. The most common trailers pulled by tractors are reported are flatbeds (30%) and two axle box vans

[6] MT-WT is the average empty weight of the group. Loaded weight is the average weight of the vehicle in its loaded state.%-Empty is the fraction of trips where the average vehicle is empty. Avg-weight is the weight considering empty trips. Avg-Miles is the annual miles driven adjusted for the full year by FHWA. Avg-Odometer is the group average odometer reading.

[7] VIUS assigns a Code for model year. Code 1 is for the current model year and future model year. Code 17 is for all vehicles 16 years old and older. ARA assigned the average age as the average code-1.

(55%). It would seem that the reported weight for these vehicles doesn't consider the trailers. These vehicles may actually fall into the HHD category. To the extent that these are in ARB's MHD inventory, these trucks should be moved to the heavy-heavy duty inventory since they tow trailers that result in increasing the combined weight to above 33,000 pounds.

Table 10 contains data from Appendix G of the Staff Report that details ARB's analysis of the MHD fleet.

Table 10
ARB MHD Fleet Data -2008

	Count	Age	Odom	MPY
MH-IN-State	198,525	8	206,852	20,008
MH-Interstate	8,896	5.4	161,306	22,098
MH-AG	9,438	17.3	293,027	11,327
MH-Utility	2,798	7.2	56,377	6,238
Total Fleet	219,657	8.3	206,793	19,544

We assumed that the VIUS fleet included only California registered MHD vehicles on the roads in California called the "In-State" MHDD fleet. Generally, the fleet age, odometer reading and annual mileage are consistent in the two analyses.

The VIUS MHDD fleet consists of 267 vehicles. Scaling VIUS inflation adjusted VMT to the State Fleet Count of 198,525 vehicles in 2008 yields 11,177,973 Miles traveled per day, which compares well with the ARB's daily VMT of 12,731,247 miles per day.

We also compared the Odometer versus age distribution for our fleet and that from ARB. The VIUS data agree well with figure 9 in appendix G of the Staff Report.

Using the emission factors in Appendix G of the Staff Report, we computed the total emissions for the fleet.

MHD Fleet by Annual Miles

The MHD sample was divided into weight groups and each weight group was characterized at annual miles driven of various quantities. Because we believe that including 26,000-33,000 pound tractors in the MHD class is erroneous, we removed these vehicles from our analysis. The data suggest that these vehicles exhibit different characteristics as they are older, have significantly higher Odometer readings and are driven more miles than single unit MHD vehicles.

Figure 3 presents the annual miles traveled as a function of the number of vehicles in each mileage grouping. The properties are summarized in Table 11. It is evident that a significant number of vehicles travel very few miles annually. *What is important is not the number of such vehicles, but their emissions contribution*.

Table 11 shows that the low annual mileage fleet is older, but not more heavily used. The total odometer is not correlated with annual use. The "avg trip" is characterized in VIUS as value 2 under 50 miles per trip and value 3 between 51 to 100 miles per trip. The "avg trip" is also uncorrelated with annual use and typically under 100 miles.

ARB found that the portion of the MHD fleet with VMT of 5,000 miles and less is 229,994 miles per day. ARA found a value of 206,997 miles per day which we believe is in complete agreement considering that we removed tractor-trailers from our fleet. At 5,000 miles, the total vehicle count is 32,218 and compared to Table 27 Appendix G values of 32,264. ARB found a NO_X inventory of 3.29 tons per day for this fleet. We found an inventory of 2.58 tons per day with tractor-trailers and 2.0 tons per day with single unit trucks only with emissions scaled to the ARB total MHD fleet emission. We estimated emissions from the running exhaust emission factors tabulated by ARB. We calculated an emission for each vehicle in the sub fleet based upon its emission model year and odometer reading.

Table 11
Properties and Emissions from Single Unit MHD Fleet for 2008
As Scaled from VIUS

Single Unit Fleet

Miles/Year	2,500	5,000	7,500	10,000	20,000	25,000	35,000	50,000	All
Age	11.2	10.2	10.1	9.8	9.0	8.6	7.9	8.1	7.7
SU-Count	16,989	27,939	39,148	46,646	106,584	135,791	161,054	179,502	186,314
Avg Travel	2.3	2.4	2.3	2.1	2.2	2.3	2.3	2.5	2.4
Odometer	177,056	170,446	151,675	154,578	156,755	160,223	165,988	185,641	182,897
VMT	64,114	199,446	390,261	855,896	3,424,887	5,617,690	7,884,423	10,319,900	11,776,453
NO_X-SU	0.69	2.05	3.96	8.70	33.33	52.53	72.36	97.44	111.50
PM-SU	0.03	0.07	0.14	0.28	1.19	1.75	2.46	3.53	3.93
% Inventory									
VMT	0.11%	0.35%	0.68%	1.50%	6.01%	9.85%	13.83%	18.10%	20.66%
NO_X , TPD	0.08%	0.24%	0.46%	1.01%	3.88%	6.11%	8.42%	11.34%	12.98%
PM, TPD	0.09%	0.21%	0.41%	0.86%	3.59%	5.27%	7.43%	10.65%	11.86%

Tractor Trailer Fleet

TT-Count	2,695	4,279	4,279	4,279	6,667	7,167	8,899	10,797	12,211
VMT-TT	6,875	28,411	28,411	28,411	131,623	163,132	325,671	563,156	954,794
NO_X, TPD	0.09	0.38	0.38	0.86	1.66	2.01	4.44	7.40	12.50
PM, TPD	0.00	0.02	0.02	0.04	0.08	0.09	0.31	0.45	0.67

We assumed that vehicle model year was equivalent to engine model year. This is supported in Zhou. The emission factors from Table 17 Appendix G of the Staff Report were used and the 2008 factors were adjusted for the mix of 2009 and 2008 vehicles per the Appendix G age distribution as well as for the average age vehicle over 16-years. Using the emission factors for MHD vehicles and the model year and Odometer readings for each vehicle in the fleet, the VIUS data were used to compute fleet emissions. For the entire MHD fleet including tractors, the raw emissions totals are 156 TPD for NO_X and 10.8 TPD for PM compared to 124 TPD and 4.6 TPD developed by ARB. The fleet emission factors are 12.0 g/mi for NO_X and 0.83 g/mi for PM respectively. These are significantly higher than those derived from the fleet emissions for this portion of the fleet as developed by ARB. We normalize our calculations to the ARB emissions. These were then scaled to the 2008 ARB inventory as a function of annual miles assuming the scaling factors for NO_X and PM were constant.

Table 12 shows the fleet emission factors at 5000 miles and for the average fleet for 2008. These are back calculated from the emission tons and VMT.

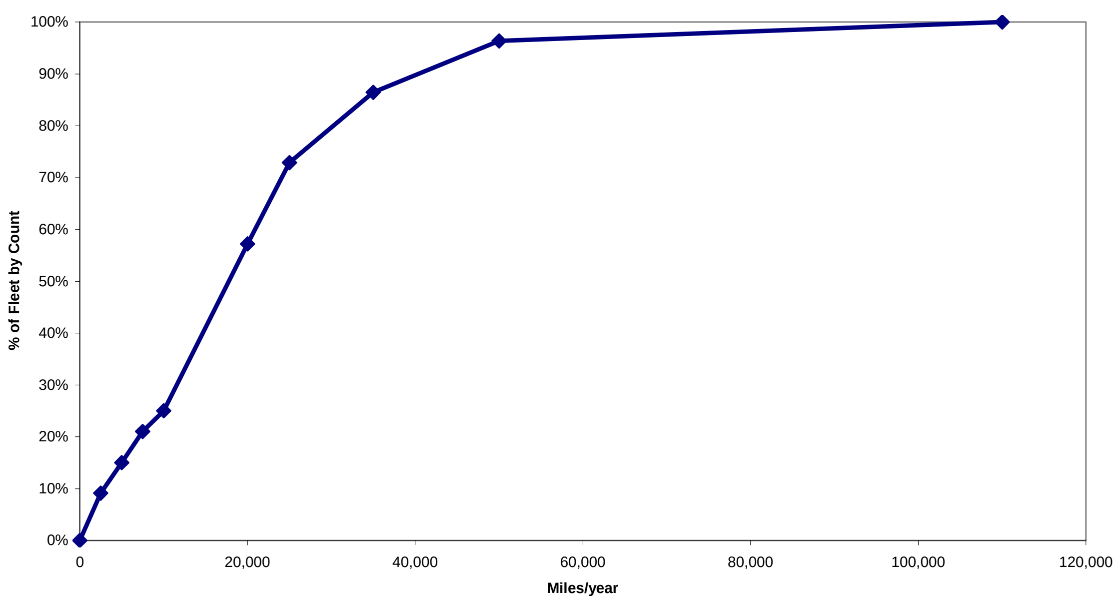
Table 12
Overall Emission Factor Comparison

	5000 miles per year		Fleet Average	
	ARB	ARA	ARB	ARA
NO_X	13.06	9.69	8.84	8.84
PM	0.64	0.35	0.33	0.33

The comparable fleet average emission factors necessarily are the same. Since Table 11 shows that the trip parameter is independent of annual miles accumulated, the trip parameters that define the overall emission factors should be essentially the same regardless of annual miles. Also, since the odometer reading is independent of annual miles, the adjustment for deterioration should be similar. Since the 5000-mile fleet is only 3 years older, age effects and speed adjustment factors don't seem to explain the 48% and 93% increases in the emission factors for the 5000 mile fleet compared to the average fleet for the ARB analysis.

The rows % Inventory NO_X and PM are the contributions of the MHD single unit fleet to the total on-road truck as a function of the number of miles per year. Even at 10,000 miles per year, ARA calculates that the entire contribution to the fleet inventory is on the order of only 1% of the NO_X and 1% of the PM. This seems inconsequential and from an economic perspective, very expensive NO_X and PM to control.

Figure 3 Cumulative Distribution, MHD Annual Miles



Comparison to Other Fleet Segments:

The division between MHD and HHD fleets is somewhat arbitrary. Engines for a given model year are all certified to the same standards. The principal difference in emission factors between MHD and a major segment of the HHD fleets is related to driving cycle. MHD truck trips tend to be shorter and possibly exhibit more transient operation. Much over the road truck driving is at freeway speeds. The single unit HHD fleet is contains a significant number of trash, concrete, dump, and tanker trucks. The driving cycle for the single unit MHD and HHD fleets should be similar. This conclusion is supported by the similar annual mileage accrual of all of the single unit trucks.

We do not know how ARB accounted for trash vehicles in the HHDD fleet since these are covered by a separate regulation. We did not attempt to sort the HHDD SU fleet for agricultural vehicles or trash vehicles. We computed the total emissions from the (unadjusted?) emission factors as tabulated by Zhou. Table 13 shows that we predict total HHDD SU fleet emissions that agree well with ARB's totals.

We computed the HHD single unit fleet emission contribution for the fleet at 7,500 miles. At 7500 miles, the fleet age is 12.7 years, the odometer is 231,183 miles, and the trip indicator average is 2.2 when removing vehicles listed as used primarily off-road. The low odometer is consistent with the low use nature of the vehicles. This has a significant effect on the deterioration contribution for emissions. The trip parameter suggests that the average trip is near 50 miles and confirms that the single unit MHD and HHD trucks have similar driving patterns. Table 13 provides the estimated inventories based upon appropriate weighted sums of the relevant variables. The VMT, NO_X and PM are about 75% of those from ARB's analysis. The weighted emission factors are in good agreement. At equal VMT, the NO_X emission would be 2.57 TRPD and the PM emission would be 0.12 TPD, and we reproduce the PM emission while NO_X is underestimated by 9%. What is important is that we would have expected that the NO_X and PM emission factors would have been 50% and 100% larger respectively mirroring the MHD calculations.

Table 13 HHD SU Fleet Data

	ARB		ARA	
7500 Miles	NO_X	PM	NO_X	PM
VMT	122,180		91,322	
TPD	2.81	0.12	1.92	0.09
EF, g/mi	20.73	0.89	19.1	0.89
Total Fleet				
VMT	3,410,860		3,410,860	
TPD	57.8	1.9	59.4	2.5
EF, g/mi	15.4	0.51	15.8	0.65