

State of California  
AIR RESOURCES BOARD

**STAFF REPORT: INITIAL STATEMENT OF REASONS FOR  
RULEMAKING**

**PUBLIC HEARING TO CONSIDER AMENDMENTS TO  
REGULATIONS REGARDING NEW AFTERMARKET CATALYTIC  
CONVERTERS AND USED CATALYTIC CONVERTERS OFFERED  
FOR SALE AND USE IN CALIFORNIA**

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This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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## EXECUTIVE SUMMARY

Staff is proposing amendments to the procedures it uses to evaluate and approve aftermarket catalytic converters designed for use on California passenger cars and trucks. These amendments would establish more stringent emission performance and durability requirements for new aftermarket converters offered for sale in California, consistent with downward trends in vehicle emission levels under ARB's Low Emission Vehicle (LEV) program and technological advances in the design of original equipment catalytic converters on new vehicles. The proposed amendments would also eliminate the current provisions allowing the sale and usage of used catalytic converters in California, effective July 1, 2008 or 30 days after the amendments are filed with the Secretary of State's office, whichever date is later.

ARB's current regulations governing aftermarket catalytic converters, adopted in 1988, require manufacturers to demonstrate that their converters will reduce engine out emissions by at least 60 to 70 percent for 25,000 miles of vehicle use. However, vehicles currently being sold in California can require catalyst conversion efficiencies in excess of 95% in order to comply with the more stringent emission standards that have been adopted since the late 1980s. Further, catalytic converter technology has improved to the point where aftermarket converters can be designed to achieve a significantly higher level of performance in a cost effective manner.

The proposed amendments would replace, beginning January 1, 2009, these existing requirements with performance standards based on reducing engine out emission levels to the point that in-use vehicles equipped with aftermarket catalysts can comply with certification emission standards. The required durability period for these aftermarket converters would be extended from 25,000 miles to 5 years or 50,000 miles of use. The amendments would also require manufacturers to demonstrate that their catalysts are compatible with vehicle on-board diagnostic systems for 1996 and newer vehicles, warrant that the converters are free from defects, and implement quality control procedures to ensure production components perform as expected in-use.

ARB regulations currently permit the practice of reselling used original equipment catalytic converters, provided that businesses implement an ARB approved screening process to ensure that the converters still have a reasonable level of performance. However, staff believes that screening for levels of performance comparable to those being proposed for new aftermarket converters would be prohibitively expensive, costing more per test than the entire value of a used converter. Therefore, staff believes its proposal to sunset the provisions permitting the sale of used converters is more appropriate than establishing a procedure for which compliance would be economically infeasible.

Staff estimates that the proposed requirements would reduce hydrocarbon (HC) and oxides of nitrogen (NOx) emissions from on-road vehicles by approximately 36 tons per day by the year 2012. New aftermarket catalytic converters designed to meet

the proposed requirements would cost up to \$200 more per unit than those currently available for older vehicles. However, due to the substantially better emissions performance and durability requirements of these converters, staff estimates indicate that the proposed requirements would be highly cost effective at approximately \$3 per pound of HC+NOx emission reductions.

## I. INTRODUCTION

State law generally prohibits the installation, sale, offer for sale, or advertisement of emission-related parts for motor vehicles that are not functionally identical to those installed by the original equipment manufacturer (OEM). However, ARB regulations allow new aftermarket catalytic converters to be used on older vehicles operating within California provided that they comply with established performance requirements. These performance requirements balance the continued need for controlling emissions from motor vehicles as they age against the cost of replacing catalytic converters on vehicles that often have a limited remaining lifetime and relatively low marketplace value.

Over the past twenty years, the performance and durability of motor vehicle emission controls have significantly improved, and the performance requirements for new aftermarket converters likewise need to be updated. Emission reductions from motor vehicles that require catalytic converter replacements are both necessary and achievable, and the improved performance and durability of new aftermarket catalytic converters meeting staff's proposed regulatory amendments would provide for significant additional benefits from older California vehicles in a cost-effective manner.

## II. BACKGROUND

Catalytic converters reduce vehicle exhaust emission levels by chemically converting engine-out emissions before the exhaust gas leaves the tailpipe. A converter contains a substrate that directs exhaust gases through narrow channels coated with precious metals that initiate the conversion of pollutants into primarily carbon dioxide and water vapor.

Since their introduction in the mid-1970's, catalytic converters continue to be the single most important technology for the control of emissions from gasoline powered motor vehicles. Current catalytic converter designs are more than 95% efficient in removing the hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) from engine exhaust before they reach the atmosphere. Improvements in catalytic converter washcoats, precious metal loading, and substrate designs over the years, in combination with better vehicle fuel control systems, are the primary factors that have made compliance with California's very low emission standards possible.

Although original equipment manufacturer (OEM) catalytic converters are designed and certified to last for at least 100,000 to 150,000 miles on newer models, heat, vibration, and poisons can eventually reduce catalytic converter efficiencies to the point that older vehicles will not be able to meet Smog Check emission limits. Such converters need to be replaced; however, OEM replacement converters are typically expensive, costing from \$500 to over \$1000. Compounding the problem, many vehicles requiring a replacement converter have considerably less than 100,000 miles of expected life remaining, making such large repair costs difficult to justify.

In order to provide for lower cost aftermarket catalytic converters, ARB adopted regulations in 1988 that permit the sale and installation of non-OEM replacement catalytic converters in California vehicles. The requirements specified minimum conversion efficiencies for aftermarket converters through 25,000 miles of use. The conversion efficiencies of 70 percent for HC and CO and 60 percent for NOx were chosen primarily to provide for consistency with federal converter replacement policies. However, the NOx efficiency requirement was adjusted upward from the 30 percent federal specification because of the need for greater NOx reductions in California. ARB testing at the time indicated that 60 percent NOx conversion efficiency was reasonably comparable to the performance of higher mileage, but properly maintained, original equipment converters used on vehicles with emission control technologies of that day.

Since then, emission standards for light- and medium-duty vehicles have decreased dramatically through ARB's low emission vehicle (LEV I and LEV II) requirements. OEM catalyst performance has correspondingly increased substantially due to improved formulations and substrate designs that provide for higher efficiencies and faster warm-up times. Therefore, an update to the requirements for aftermarket catalysts is needed to ensure that the in-use emission performance of current technology vehicles is not adversely compromised by the use of non-OEM replacement catalysts.

Another significant advance that occurred in the 1990's was the implementation of On-Board Diagnostic II (OBD II) systems on light- and medium-duty vehicles. These systems use the vehicle's on-board computer to monitor the performance of its emission control systems, including the catalytic converter. Aftermarket catalytic converters meeting the current converter conversion efficiency requirements are generally not compatible with vehicle OBD II systems because their level of performance, even when relatively new, can fall below the levels at which the OBD II system will indicate a malfunction.

Because some OBD II equipped vehicles are now more than 10 years old, the need already exists in the marketplace for aftermarket catalytic converters that are compatible with these vehicles. As a short term solution, staff has drafted specifications and test procedures for OBD II-compatible aftermarket converters, and most aftermarket catalytic converter manufacturers have agreed to use these procedures to produce aftermarket converters capable of allowing OBD II-equipped vehicles to meet emission standards for a period of 5 years or 50,000 miles. Further, the converters are designed to ensure that vehicle OBD II systems do not falsely indicate a malfunction based on replacement of the OEM converter. The proposed amendments described below for new aftermarket catalytic converters are largely based on the same concepts initially developed in the context of these agreements.

### III. COMPARABLE FEDERAL REGULATIONS

The United States Environmental Protection Agency (U.S. EPA) addressed the subject of aftermarket catalytic converters by issuing an interim enforcement policy

in 1986. The policy permits the sale of aftermarket converters provided they meet conversion efficiencies of at least 70 percent for HC and CO, and 30 percent for NOx. The federal requirements are therefore similar to California's current conversion efficiency requirements, except that the federal specifications for NOx conversion are only half of California's 60 percent requirement. Some procedural differences also currently exist; for example, ARB's regulation requires converter manufacturers to demonstrate compliance with its requirements before an approval is issued, whereas the federal requirements permit manufacturers to self-determine compliance. Since issuing its enforcement policy, U.S. EPA has thus far decided not to issue regulations specific to aftermarket catalytic converters, and has not announced any plans to do so in the near future.

#### IV. PROPOSED AMENDMENTS

##### A. New Aftermarket Converter Performance Requirements

###### 1. Non-OBD II Vehicles

Staff proposes to change the new aftermarket converter performance requirements from standards based on converter efficiency to standards based on vehicle tailpipe emission levels for converters advertised, sold, or installed on or after January 1, 2009. The proposal would require aftermarket converter manufacturers to specify the vehicle and exhaust system categories that each of their catalytic converter models is designed to fit (e.g., passenger cars with a single catalytic converter exhaust design). The ARB would then select a "representative" vehicle model for each category to be used by the manufacturers to demonstrate compliance with the performance requirements. Manufacturers would test the representative vehicle with an aftermarket converter that has been aged the equivalent of 50,000 miles of use. The converter would pass the performance requirement if the vehicle's emissions do not exceed the limits the vehicle was certified to meet.

###### 2. OBD II Equipped Vehicles

The proposed requirements for OBD II equipped vehicles are very similar to those already being met by most aftermarket catalytic converter manufacturers through interim agreements with the ARB. Manufacturers would assemble a list of vehicles that each new aftermarket converter is designed to work with. Staff would then select one or more representative vehicles from the list for the manufacturer's compliance determination. Similar to the proposed requirement for non-OBD II vehicles, the manufacturer would then demonstrate through emission testing of an aged converter that the test vehicles are capable of meeting their emission standards. The proposed requirements for OBD II equipped vehicles would also become effective on January 1, 2009.

The proposed procedures would also require a demonstration of OBD II compatibility. Manufacturers would demonstrate through the emission testing that their new aftermarket catalytic converters would not cause a test vehicle's

Malfunction Indicator Light (MIL) to illuminate when the catalyst is functioning properly. The manufacturers would then severely age a prototype converter to demonstrate that the test vehicle's OBD II system will detect the converter as malfunctioning by the time its conversion efficiency deteriorates to the point that vehicle emissions exceed the manufacturers' limits for malfunction detection by no more than a factor of 50 percent.

#### B. Warranty Requirements

The proposed procedures would require manufacturers to warrant their aftermarket converters for 5 years or 50,000 miles, (compared to a 25,000 mile warranty period in the existing procedures). The warranty would cover failures related to conversion efficiency performance, OBD II compatibility (if applicable), and physical problems such as corrosion or leaks in the outer shell or connecting pipes. If a problem covered under warranty does occur, both the cost of a new component and installation labor would be free of charge to the vehicle owner.

Manufacturers would be required to monitor warranty claims on an ongoing basis and report to ARB when the rate of claims exceed 4 percent, or the total number of claims exceeds 100, for a particular converter design. For confirmed warranty rates above these levels, manufacturers would be required to report the probable cause for the failures and the impact of the failures on vehicle emissions. If ARB determines that the data demonstrates that systematic failure of the converters is occurring, and that the failures significantly impact vehicle emission levels, further sale of the converters can be suspended until the cause of the failures has been corrected.

#### C. Labeling Requirements

Proper labeling of aftermarket catalytic converters is essential to facilitate verification during a Smog Check that the vehicle is operating with an approved converter. The proposed procedures would require manufacturers to apply a permanent label or stamp to the converter shell that indicates ARB's approval number for the converter design, the part number, the date of manufacture, and an arrow indicating the proper installation direction for the converter.

#### D. Quality Control Procedures

The proposed amendments would require manufacturers to monitor the aftermarket catalytic converter production process to ensure that production components actually meet the specifications upon which ARB approval is based. Manufacturers would check for adequate precious metal content, base metal content, and washcoat loading. Inspections to ensure proper application of the washcoat, installation of matting materials, and the absence of leaks in the converters shell would also be required.

Manufacturers must evaluate at least one percent of the converters produced in each lot. If a sampled converter fails one or more of the quality control checks, all converters produced from the time of the last passing sample must be evaluated before they can be released for sale, and all failing converters must be reprocessed or destroyed. The proposed procedures would require manufacturers to report the results of their quality control checks to ARB on a quarterly basis.

#### E. Application Process

Manufacturers would be required to initiate ARB approval of aftermarket catalytic converters by submitting an application for exemption. The proposed procedures specifically list the information and data that must be included in the application. Staff will issue an exemption for the aftermarket catalytic converters covered by the application only after it determines that all required information has been submitted, and that the information demonstrates that the aftermarket converters comply with the procedures' requirements.

#### F. Installation Requirements

Ensuring that vehicles are properly fitted with approved aftermarket converters at the point of sale is critical for realizing the full expected benefits of the program. Therefore, the procedures also set forth requirements that apply to individuals and businesses that sell and install aftermarket converters. The proposed procedures would require installers to: 1) ensure that each aftermarket converter has been approved by ARB for installation on the vehicle model in question, 2) verify that each vehicle needing a new aftermarket catalytic converter is outside of the vehicle manufacturer's warranty period for the original equipment converter (typically 7 years or 70,000 miles), 3) establish a legitimate need for an aftermarket converter by first examining the existing converter and exhaust system, and 4) install the aftermarket converter in the same location as the original equipment converter on a one-for-one basis, and without relocating or removing other converters or exhaust oxygen sensors.

#### G. Used Original Equipment Catalytic Converters

Staff's proposed amendments would eliminate, effective July 1, 2008, or 30 days after the amendments are filed with the Secretary of State's office, whichever date is later, the current provisions allowing the advertising, sale, and installation of used OEM catalytic converters. Staff believes that continued availability of used OEM catalytic converters would only be appropriate if they are individually tested to demonstrate that their emission performance is comparable to the proposed requirements for new aftermarket catalysts. However, staff is not aware of any economically feasible screening test that can reliably demonstrate that a current technology vehicle will operate within its emission standards for 50,000 miles of vehicle operation when a used converter is installed. Further discussion of the considerations behind staff's proposal for used converters is presented in detail below.

## V. ISSUES REGARDING THE PROPOSAL

### A. Prohibiting the sale of used OEM catalytic converters

Staff's proposal would eliminate current provisions allowing the advertising, sale, offering for sale and installation of used OEM catalytic converters. Staff believes this amendment is necessary because no economically feasible screening method exists that can reliably evaluate whether a used converter will perform at levels comparable to those required of new aftermarket converters produced in compliance with staff's proposed amendments. This proposed change will have a significant impact on the three businesses that currently offer used converters for sale in California.

Under current regulations, businesses may apply to ARB for permission to sell used catalytic converters in California if they implement a process by which they screen out overly deteriorated or chemically "poisoned" parts, and determine what vehicle applications each used converter is compatible with. The process is consistent with the U.S. EPA's interim enforcement policy for used converters (51 Fed. Reg. 28114 (August 5, 1986) and 51 Fed. Reg.28132 (August 5, 1986).

When a used catalytic converter is removed from a vehicle for the purposes of reselling it, the emission performance of the converter is unknown, aside from what might be inferred from the age and mileage of the vehicle. The used converter may be able to achieve high conversion efficiencies, or it may have experienced in-use operating conditions that have caused it to be severely deteriorated. Therefore, the process of certifying these converters for resale requires that the condition of each unit be evaluated for its ability to reduce emissions.

Because every used converter must be tested to determine if it performs satisfactorily, the test procedure used for screening must be inexpensive relative to the value of the converters. Otherwise, testing costs will drive up the price of used converters beyond what the market will permit. Used catalyst resellers have been able to achieve this requirement by using test rigs that can evaluate steady-state conversion efficiencies at levels comparable to those that new aftermarket converters are required to achieve under the existing procedures for pre-1996 model year vehicles (i.e., efficiencies above 60 to 70 percent). However, these basic test methods cannot be modified to reliably evaluate whether a used converter is capable of achieving the substantially higher levels of conversion efficiency that all new aftermarket catalytic converters would have to meet under the proposed requirements. Further, the test methods being used cannot evaluate converter performance during transient or cold start vehicle operating conditions (critical elements to a converter's emission reduction performance) without correspondingly greatly increasing the cost of the test. As a point of reference, the type of emission tests that new aftermarket catalytic converter manufacturers would use to ensure that their converters meet the performance levels proposed by staff typically cost \$1500 or more per test.

In discussions with one company that currently resells used original equipment converters, the concept of using vehicle OBD II systems for screening was explored for 1996 and newer vehicles. That is, whether or not a used converter still has adequate life left would be based on whether or not it is detected as malfunctioning by the vehicle it is installed on. Converters that are detected as malfunctioning too soon after installation would be replaced under warranty.

While all 1996 and newer model year vehicles have OBD II diagnostic systems to monitor the health of the converter and alert the driver when it malfunctions, tailpipe emissions are typically 1.5 to 4 times the hydrocarbon (HC) standards when this occurs, and oxides of nitrogen (NOx) emissions may be higher still. These margins above the emission standards were established by the OBD II regulation to ensure that monitored components are not flagged by the OBD II system until their performance has clearly degraded to the point that emission standards are no longer being met. As such, reliance on the OBD II system to evaluate a used converter is not an affirmative determination that a used replacement converter has brought emissions from the vehicle back into compliance with emission standards or that the converter has significant life remaining. Consumer experiences with such a concept would likely be highly variable. Some may experience a long period of time with good emission performance and no malfunction indications while others may immediately need to have the converter replaced again (and could possibly need multiple converter replacements in a short period of time). Staff believes this approach would create confusion and dissatisfaction should newly purchased “legal” parts immediately fail and need to be replaced. Further, the loss of important emission benefits would likely result from replacement parts that, from the time of installation, are inadequate to properly control vehicle emission levels.

In light of these circumstances, staff believes that phasing out the existing provisions allowing the use and sale of used OEM converters is the best available course of action. Leaving the used converter provisions unchanged, or proposing performance requirements that are only somewhat more stringent than the existing used aftermarket catalyst performance requirements because better screening procedures are not reasonably available, would create an inequity between the requirements for used converters as compared to those for new aftermarket converters, potentially undermining the benefits of staff’s proposal. Raising the screening requirements to test used converters for comparable levels of performance regardless of costs is a regulatory possibility; however, staff believes the used converter provisions would be economically infeasible. Moreover, merely having such requirements might mislead the public that a used OEM converter business is viable in California.

Used converter resellers have indicated they play a unique role in providing an affordable alternative to an original equipment replacement converter for vehicles when no new aftermarket converter is available. Staff acknowledges that, as with any part, an aftermarket company has to determine that a valid business case exists for designing and producing a part for low volume vehicle models or for designing and producing a component that might be difficult to manufacture and sell at a cost that is sufficiently lower than for the OEM component. As a result, it is possible that

the purchase of a new OEM converter may be the only option in some circumstances should ARB staff's proposal to sunset provisions for the sale of used converters be adopted. However, the ARB staff believes the importance of equitable requirements that provide for significant and cost-effective emission reductions for the vast majority of California vehicles outweighs any negative impact resulting from higher catalytic converter replacement costs that might occur for a relatively few vehicles.

#### B. Increased prices for new aftermarket catalytic converters

Aftermarket catalytic converters for pre-OBD II vehicles currently cost between approximately \$60 and \$150 with \$100 as a very typical average price. Staff estimates that the average price of an aftermarket converter for pre-OBD II vehicles will initially increase by up to \$200 as a result of the proposed amendments. Consumers therefore could see prices increase to up to four times current levels under the proposed amendments. While the expected price increases may initially seem excessive, the new aftermarket converter designs would provide better, more durable performance, and costs would actually remain reasonably consistent with historical costs when considering average increases in vehicle values over time.

New aftermarket converters meeting the proposed requirements would be designed to be twice as durable as those meeting the existing requirements (50,000 versus 25,000 miles). Therefore, consumers would be less likely to need to purchase a second or third catalyst during a vehicle's lifetime. On the basis of cost per mile of use over their lifetime, the increased durability of converters meeting the proposed requirements would cut their cost increase by a factor of two. At the prices indicated above, current aftermarket converters cost between 24 to 60 cents per 100 miles driven over their lifetime. Converters meeting the proposed requirements would cost between approximately 52 to 70 cents per 100 miles driven. Staff believes in the longer term that the incremental cost of aftermarket converters meeting the proposed requirements could drop below \$200 on average as production volumes increase and manufacturers gain experience necessary to maximize the number of vehicles models for which compliance with a specific converter design can be achieved. Any price reductions that occur would further reduce the incremental cost impact of the proposed requirements.

When ARB adopted the current performance requirements for new aftermarket catalytic converters in 1988, staff estimated that the average cost of a converter would be \$205. Considering that average vehicle values (based on manufacturer suggested retail prices) have essentially doubled since 1987<sup>1</sup>, even the high-end estimated cost of \$350 would, as a function of vehicle value, be less under the proposed amendments. In general, aftermarket converters today cost considerably less than ARB's 1988 estimate because manufacturing improvements over the past two decades, most notably better formulations and catalyst washcoat technologies,

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<sup>1</sup> Ethan Abeles, Institute of Transportation Studies, University of California, Davis, "Analysis of Light-Duty Vehicle Price Trends in the U.S.," June 2004.

have permitted catalyst manufacturers to design and produce products that achieve the same level of emissions performance while using far less precious metals.

## VI. AIR QUALITY, ENVIRONMENTAL, AND ECONOMIC IMPACTS

### A. Air Quality

Staff developed an emission benefit estimate that applies to the non-OBD II equipped California fleet that is subject to Smog Check. Aftermarket catalytic converters for OBD II equipped vehicles are currently only being approved under interim agreements with the ARB. Because the performance requirements being implemented through the agreements are very similar to the proposed requirements, staff does not believe that a significant emission benefit can be calculated. Notwithstanding this, the Board’s adoption of the proposed requirements for OBD II vehicles would formalize the requirements included in the interim agreements and would provide for minor procedural improvements.

The emission benefit estimate for the statewide non-OBD II fleet is based on vehicle emission data obtained from a previous test program conducted at ARB’s Haagen-Smit Laboratory. A total of fourteen procured test vehicles were baseline tested. In order to screen out vehicles with underlying emission-related problems, the test vehicles were required to pass a Smog Check inspection in their as-received condition before being included in the test program. Once included, the vehicles were fitted with an aftermarket catalytic converter. Some of the test vehicles received aftermarket catalysts meeting ARB’s current requirements for non-OBD II vehicles, and the remaining vehicles were fitted with catalysts designed to meet the proposed performance requirements. Emissions tests were conducted after the aftermarket converters were installed and the vehicles were then returned to their owners for mileage accumulation. The vehicles were later re-procured and tested again. A summary of the as-received test data is presented in Table 1.

Table 1 – Baseline Test Vehicle Characteristics

Test Vehicles with Converters Meeting:	Sample Size	Average Model Year	Average Mileage	Baseline Emission Levels (g/mile)		
				HC	CO	NOx
Current Requirements	5	1987.0	139,644	0.585	6.129	0.876
Proposed Requirements	9	1989.0	160,700	0.393	4.648	0.747

Table 2 shows the change in emission levels after the converters on the vehicles were replaced with aftermarket converters. The testing occurred while the aftermarket converters were still “green” (i.e., no significant mileage accumulation occurred to stabilize conversion efficiencies).

Table 2 – Emissions with Green Catalytic Converters

Test Vehicles with Converters Meeting:	Emission Levels (g/mile)			Benefits wrt Baseline (g/mile)		
	HC	CO	NOx	HC	CO	NOx
Current Requirements	0.311	2.389	0.493	0.274	3.740	0.382
Proposed Requirements	0.162	1.027	0.342	0.232	3.621	0.406
<b>Difference</b>	<b>0.149</b>	<b>1.362</b>	<b>0.152</b>	<b>0.042</b>	<b>0.119</b>	<b>0.023</b>

Table 3 summarizes the emission levels of the same vehicles after mileage accumulation, and presents the resulting emission “benefits” of the aftermarket converters compared to the baseline values in Table 1. Negative benefit values indicate that emissions from the test vehicles after mileage accumulation were higher on average than the baseline readings taken with the original converters still installed. These negative values likely indicate that the aftermarket converters on average were performing at a lower level than the original catalyts. However, this does not necessarily suggest that the aftermarket converters were failing to perform as expected, keeping in mind that the original converters were likely still in good condition (as evidenced by passing Smog Check results).

Table 3 – Vehicle/Catalyst Emission Performance After Mileage Accumulation

Test Vehicles with Converters Meeting:	Average Mileage Accumulation	Emission Levels (g/mile)			Benefits wrt Baseline (g/mile)		
		HC	CO	NOx	HC	CO	NOx
Current Requirements	8,754	0.605	4.987	1.431	-0.020	1.141	-0.556
Proposed Requirements	7,847	0.253	2.227	0.358	0.141	2.420	0.389
<b>Difference</b>	<b>908</b>	<b>0.352</b>	<b>2.760</b>	<b>1.073</b>	<b>0.160</b>	<b>1.279</b>	<b>0.945</b>

Having established the data to be used for the analysis, staff used three sets of information to calculate the tons-per-day benefit of the proposed amendments:

1. The average difference in emission rates (when using converters meeting the proposed requirements compared to using converters meeting the current requirements).
2. The population of vehicles in California that will be equipped with aftermarket converters, and
3. The average number of miles these vehicles drive per day.

### Emission Rates

Determining the average emission rate requires knowledge of how emissions change as a function of mileage accumulation when the aftermarket catalyts are installed. In this case, what is really needed is the change in emissions for the two groups of vehicles relative to each other. Although a linear deterioration rate can be calculated using the emission values obtained with green catalyts and after mileage accumulation, staff believes that the use of the green catalyst data would result in an overestimation of the deterioration rate because green catalyts are generally very efficient initially, but their efficiency quickly declines in a non-linear fashion until the catalyst is stabilized. Without the green-catalyst data, however, deterioration rates cannot be determined from the single remaining data point after mileage accumulation.

Staff's estimate resolves this problem by assuming that the deterioration rates for the current and proposed aftermarket catalysts are the same. This means that the difference in emission performance between the two types of catalysts observed after mileage accumulation is assumed to be constant throughout the expected lives of the catalysts. In reality, aftermarket catalysts meeting the proposed requirements would likely deteriorate at a slower rate. Staff bases this statement on the fact that the deterioration rate for the current aftermarket catalysts is far greater than for the proposed catalysts when the green catalyst data is considered, and the fact that the proposed catalysts would be required to maintain a higher catalyst efficiency for twice the length of time compared to existing aftermarket catalysts. Any error introduced with this assumption regarding deterioration rates would only result in a more conservative emission benefit. Without being able to more accurately quantify deterioration rates, staff believes using a more conservative approach is appropriate.

Once it resolved the issue of calculating aftermarket catalyst deterioration rates, staff considered two ways to calculate the difference in performance for the two types of catalysts. The first approach used the difference in tailpipe emission levels after mileage accumulation. The second approach used the difference in emission benefits after mileage accumulation with respect to the baseline emission levels for each set of vehicles. Both values are presented in Table 3 above. Staff believes that comparing the benefits of the aftermarket catalysts with respect to baseline emissions (the second method) is the better approach, because the baseline emissions for the vehicles fitted with current aftermarket catalysts is higher than the baseline emissions of the vehicles fitted with the aftermarket catalysts designed to meet the proposed requirements. A greater absolute emission reduction would therefore be needed for current catalyst equipped vehicles as compared with the vehicles using the proposed aftermarket catalysts to attain the same tailpipe emission level (assuming the higher baseline emission levels are at least in part attributable to higher engine out emission levels). Furthermore, comparing the emission benefits with respect to the baseline level should slightly favor the current aftermarket catalysts, because catalysts of the same efficiency should yield higher absolute emission reductions when exposed to higher feed-gas levels (e.g., a 70% reduction on a vehicle with 2.5 grams per mile engine out is greater than a 70% reduction on a 2 gram per mile vehicle). Consistent with its decision on the approach to estimating deterioration rates, staff elected to use a more conservative approach for estimating the emission benefit of the proposal.

#### Aftermarket Catalyst Populations

Staff used industry aftermarket converter sales data to estimate the number of vehicles in California in calendar year 2006 that were equipped with aftermarket catalysts. The number of vehicles so equipped in future model years can then be estimated based on the percentage of vehicles equipped with aftermarket catalysts compared to the total fleet for the model year in question.

The sales data indicates that, on average, approximately 880,000 aftermarket converters were sold per year in California over the last five calendar years. For calendar year 2006, approximately 74 percent of sales were for pre-OBD II vehicles.

Staff estimates that current aftermarket catalytic converters for pre-OBD II vehicles last about 3 years on average, after which the vehicles on which they are equipped would again fail a Smog Check inspection. This estimate is based on the assumption that the catalysts will not last long enough on 50 percent of vehicles to enable the vehicles to pass their next biennial Smog Check, and that the remaining 50 percent would not last beyond the second biennial Smog Check after their installation.

A three year average life means that in each year, roughly one third of the fleet equipped with an aftermarket converter will need a replacement. Staff therefore believes that the number of pre-OBD II vehicles equipped with aftermarket catalysts in California can be estimated by multiplying the annual sales figures of aftermarket converters by a factor of three.

As indicated in Table 4 below, the resulting estimate is that over 1.9 million pre-OBD II vehicles were equipped with aftermarket catalytic converters in Calendar Year 2006. This equates to about 30.3% of all 1977 through 1995 model year passenger cars, light-duty trucks, and medium-duty vehicles.

Table 4 – Aftermarket Catalyst Populations in California

	Percent	Number
Annual California Aftermarket Converter Sales		880,000
Portion that are for pre-OBD II vehicles	74%	651,200
Number of pre-OBD II vehicles equipped with aftermarket catalysts in CY2006 (based on 3 yr average life)		1,953,600
Portion of CY 2006 fleet (1977-1995 Model Years)	30.3%	

The proposed revisions to the requirements for pre-OBD II aftermarket catalytic converters would go into effect on January 1, 2009. Therefore, staff chose calendar year 2012 for its benefit analysis. Based on the expected three year life of aftermarket converters meeting current requirements, staff believes that most vehicles using aftermarket catalysts would be equipped with aftermarket converters meeting the proposed requirements by that time.

EMFAC estimates that about 3.5 million 1977 to 1995 gasoline powered passenger cars, light-duty trucks, and medium duty vehicles will be on the road in 2012. By taking the 2006 percentage, which indicates that about 30% of these vehicles operate with aftermarket catalysts, and scaling it up to 35% to reflect the increased use of aftermarket catalysts as the fleet continues to age, staff estimates that the 2012 calendar year population of vehicles equipped with aftermarket catalysts will be about 1.26 million.

#### Vehicle Miles Traveled

EMFAC 2007 indicates that the average miles traveled per day in 2012 for vehicles between model years 1977 and 1995 is 23.9.

## Emission Benefit Estimate Results

Table 5 below presents the emission benefit estimate that results from multiplying the difference in emission rates by the affected vehicle population and its average daily mileage. The results indicate that the statewide 2012 benefit would be 36.61 tons per day for HC + NOx emissions with the bulk of the reductions coming from NOx emissions.

Table 5 – Emission Benefit Estimate Results

	HC	NOx	HC+NOx	
Difference in Emission Rates (g/mi)	0.160	0.945	1.105	
Population of Vehicles with AM converters	1,258,680			
Average Miles Traveled per Day	23.9			
Daily Benefit (Statewide 2012)	grams/day	4,816,201	28,426,914	33,243,115
	lbs/day	10,608	62,614	73,223
	<b>tons/day</b>	<b>5.30</b>	<b>31.31</b>	<b>36.61</b>

## Cost Effectiveness

Staff has estimated the cost effectiveness of the proposed amendments to the requirements for pre-OBD II aftermarket catalytic converters. The methodology and results of the analysis are presented below.

Staff's experience with new aftermarket converters produced and sold under the interim agreements for OBD II equipped vehicles indicates that converters complying with the revised requirements will cost up to \$200 more than those meeting the current requirements. Staff assumed an average life expectancy of five years, two years longer than that estimated for converters meeting current requirements. As presented in Table 6 below, the resulting cost effectiveness is \$1.88 per pound of HC+NOx reduced. Therefore, staff expects the new requirements to be very cost effective.

Table 6 – Cost-Effectiveness Estimate

Ave Difference in Emission Rates (g/mi HC+NOx)		1.105
Yearly Average Benefit per Vehicle (grams HC+NOx)		9,640
Expected Life of Converters (years)		5
Lifetime Benefits (HC + NOx)	grams	48,200
	pounds	106.17
Average Incremental Cost (\$)		\$200
Cost Effectiveness (\$/pound HC + NOx)		\$1.88

## B. Environmental Justice

The proposed amendments apply to new aftermarket catalytic converters installed in motor vehicles that operate throughout the state. However, to the extent that older vehicles may operate more frequently in communities with lower median-incomes,

staff expects that the proposed amendments will provide these communities with a relatively greater emission benefit. Older vehicles are more likely to require aftermarket catalytic converters to replace OEM converters. The proposed amendments will ensure that these aftermarket converters will be better performing and more durable than those currently available, reducing emissions of harmful pollutants. The impact of increased prices for new aftermarket catalytic converters on low income vehicle owners should be minimized or even eliminated under the Bureau of Automotive Repair's (BAR's) Consumer Assistance Program (CAP). This program offers up to \$500 in emission-related repairs to help qualified owners' vehicles pass their Smog Check inspection. Motorists whose household incomes are at or below 225% of the federal poverty guidelines can qualify for repair assistance, as can motorists that own vehicles that BAR has directed to a Test-Only station for their Smog Check inspection. The \$500 limit should be adequate to cover the purchase and installation of a new aftermarket catalytic converter in virtually all circumstances.

### C. Economic Impacts

#### 1. Costs to Consumers

Staff estimates that the proposed amendments to the requirements for aftermarket catalytic converters will result in an increased cost per unit of up to \$200 on average. The cost increase would mostly result from the greater quantities of precious metals needed to increase catalytic conversion efficiencies to the levels necessary for compliance. Although this represents a price increase of two to four times the price for aftermarket converters meeting current requirements, the durability of converters meeting the proposed requirements is expected to be twice as long. Therefore, as described in section IV above, the cost impact of the proposed requirements would, on a cost per mile basis, increase by about 50 percent (from 42 cents per 100 miles driven to about 61 cents, on average).

As discussed in section V.A above, one result of staff's proposal to sunset provisions for the sale of used OEM converters may be that some vehicle owners have no option but to purchase a new OEM replacement converter in cases where a new aftermarket converter is not available for the vehicle model in question. Thus, the cost of replacing a converter could be \$500 to \$1000 or more. Staff believes such circumstances would be generally limited to low-volume vehicle models for which aftermarket converters cannot be sold in volumes sufficient to provide for the recovery of aftermarket catalytic converter manufacturers' development costs.

#### 2. Costs to Aftermarket Converter Manufacturers

Although aftermarket converter manufacturers would incur new research, development, and testing costs under the proposed amendments, staff expects that the costs would be amortized into the market price for the converters. Further, because aftermarket catalytic converters are manufactured and sold in high volumes, staff believes these costs would be negligible on a per piece basis.

### 3. Impact on Businesses

Although retailers' average price per converter would increase under the proposed amendments, staff does not believe retailer profits would be negatively impacted because the overall need for aftermarket catalytic converters would not be changed. The proposal should not impact the ability of any California business to compete with businesses from other states, because the requirements would apply to all converters sold, offered for sale, installed, or advertised in California, regardless of where they are manufactured.

Businesses that currently resell used original equipment catalytic converters would be impacted by the proposal to eliminate California's provisions allowing the sale of these devices. These businesses would no longer have a California market for their products, but could continue to sell products out-of-state under current federal regulations. As described in Section V.A above, this impact cannot be currently mitigated due to the lack of an economically feasible process that would be adequate to evaluate the condition of used converters prior to their resale.

#### D. Alternatives Considered

In reviewing ARB's longstanding provisions for the sale of new aftermarket catalytic converters for older California vehicles, the staff determined that apart from its proposal, two alternative courses of action were available for consideration. However, as described below, neither alternative considered by the staff would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective and less burdensome to affected private persons than the proposed requirements.

##### 1. Leaving requirements unchanged

One alternative considered by staff was to leave California's requirements for new aftermarket catalytic converters unchanged. This alternative would have the benefit of keeping aftermarket converter prices at their current low levels. Staff rejected this alternative based on its determination that significant and cost effective emission reductions from in-use vehicles would result from the introduction of better performing aftermarket converters. These reductions are necessary to help California achieve its air quality goals.

##### 2. Requiring replacement catalysts to meet OEM specifications

Staff also considered the alternative of phasing out the provisions for aftermarket catalytic converters in their entirety. This alternative would require all aftermarket catalytic converters sold in California to be functionally identical to original equipment converters in all aspects, including component durability.

Staff determined the primary benefit of this alternative would be the increased durability that OEM-quality converters would provide. They are generally designed to last for 100,000 to 150,000 miles of use, compared to the 50,000 mile durability requirements included in staff's proposed amendments. Staff would not expect

OEM-quality converters to provide a significant additional benefit over the first 50,000 miles of use because the staff's proposed amendments would require demonstration that vehicles equipped with aftermarket converters will emit at levels below applicable emission standards for the length of the durability period.

Staff rejected this alternative because many vehicles requiring aftermarket converters are not likely to have 100,000 miles of life remaining. Requiring vehicle owners to purchase OEM equivalent converters that would often be far more durable than necessary to reduce emissions from the vehicle's remaining lifetime would increase costs without providing significant additional emission benefits. OEM quality converters would cost in excess of \$500 in most cases, with some converter prices exceeding \$1000. Therefore, the cost effectiveness of this approach would be relatively poor in comparison to the staff's proposal.

## VII. SUMMARY AND CONCLUSION

The staff's proposal provides needed updates to California's requirements for the sale of aftermarket catalytic converters for motor vehicles. The proposed increases in conversion efficiency and durability would bring new aftermarket converter performance back in-line with levels necessary to ensure that vehicles designed to meet current standards will continue to have low emissions throughout their lifetime. Staff's proposal also includes other necessary amendments, including required quality control checks and improved converter labeling requirements, to further ensure that aftermarket catalytic converters perform as expected and are properly fitted to the vehicle models on which they are designed to function. The proposed revisions would cost-effectively provide for substantial emission reductions from older vehicles operating in California. These reductions are important to California's continued progress towards its air quality goals.

## VIII. REFERENCES

1. 51 Federal Register, 28114 (August 5, 1986)
2. Initial Statement of Reasons for Proposed Rulemaking: Public Hearing to Consider Regulations Regarding New and Used Aftermarket Catalytic Converters Offered for Sale and Use in California, October 16, 1987
3. Title 13, California Code of Regulations, Sections 1968.1 and 1968.2
4. Margret M. Schmidt, et al, "New Catalyst Preparation Procedure for OBDII-Monitoring Requirements", Society of Automotive Engineers, Inc. 2001-01-0933
5. Manufacturers of Emission Controls Association, "Aftermarket Converter Figures for 2006," May 18, 2007
6. Eldert Bontekoe, U.S. EPA, "Draft Strawman Durability Proposal" (presentation), January 29, 2003
7. Health and Safety Code Section 27156
8. EMFAC 2007

### Attachments

California Evaluation Procedures for New Aftermarket Catalytic Converters  
(Proposed)

Proposed Regulation Order