SUMMARY OF BOARD ITEM

ITEM # 03-3-4: Public Meeting to Consider a Report and Findings on the Exempting Additional Vehicles from California's Smog Check Program, in Response to Assembly Bill 2637 (Cardoza, 2002).

STAFF RECOMMENDATION: Staff evaluated the emissions impact of exempting five and six year old cars from Smog Check inspections. Currently, cars are exempt through their first four years of age. Staff recommends that the Board find a broader exemption would result in adverse emission impacts in Enhanced Smog Check areas that, in turn, would prohibit California from meeting its SIP commitments. In Basic Smog Check (rural) areas, the staff recommends that the Board find the exemption would not prohibit California from meeting its SIP obligations.

DISCUSSION: AB 2637 exempts new vehicles from Smog Check inspections for up to six model years, statewide, starting January 1, 2004, unless ARB finds that exempting additional vehicles would prohibit the State from meeting federal Clean Air Act conformity requirements or California's State Implementation Plan (SIP) commitments. AB 2637 is also the bill that requires the implementation of the Enhanced Smog Check Program in the urbanized portion of the San Francisco Bay Area Air Basin. The Legislature's intent was to explore whether certain program modifications were feasible before more Californians are subject to enhanced inspections. A separate, pending report to the State Legislature (to be submitted July 2003) evaluates the Smog Check Program in its entirety and is expected to make various recommendations for improving the Program's performance. Although staff has concluded that a five-year and six year exemption is not warranted at this time, staff will continue to investigate whether subgroups of clean, extremely durable five and six year old vehicles (e.g., PZEVs) could be exempted with minimal adverse emission impacts.

SUMMARY AND IMPACTS: Approval of the staff's recommendations will have two effects. First, it will leave the Enhanced Smog Check program unchanged, thereby preserving all the associated emissions benefits and ensuring compliance with the California SIP. Second, it will expand the exemption for new cars in Basic Smog Check areas from four to six model years, reducing costs to persons with cars registered in those areas.

State of California
AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER THE APPROVAL OF A REPORT AND FINDINGS ON THE EXEMPTION OF ADDITIONAL VEHICLES FROM CALIFORNIA'S SMOG CHECK PROGRAM

The Air Resources Board (the Board or ARB) will conduct a public meeting at the time and place noted below to consider the approval of a report and findings on the Exemption of Additional Vehicles from California's Smog Check Program.

DATE: **April 24, 2003**

TIME: **9:00 AM**

PLACE: **Air Resources Board**
Central Valley Auditorium, Second Floor
1001 "I" Street
Sacramento, CA 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., April 24, 2003, and may continue at 8:30 a.m., April 25, 2003. This item may not be considered until April 25, 2003. Please consult the agenda for the meeting, which will be available at least 10 days before April 24, 2003, to determine the day on which this item will be considered.

If you have special accommodation or language needs, please contact ARB's Clerk of the Board at (916) 322-5594 or sdorais@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact the Americans with Disabilities Act (ADA) Coordinator at (916) 323-4916, or TDD (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area.

In 2002 the Legislature enacted AB 2637 (Stats. 2002, Chapter 1001), which requires the establishment of an enhanced Smog Check Program in the urbanized areas of the San Francisco Bay Area Air Basin. Among other requirements, AB 2637 also provides for new motor vehicles to be exempted statewide from the Smog Check biennial inspection program for up to six model years instead of the current four model years. The increased exemption is to become effective in all Basic and Enhanced Smog Check areas beginning January 1, 2004, unless the ARB finds that exempting the additional vehicles would prohibit the State from meeting the requirements of the

section 176(c) of the federal Clean Air Act or California's commitments with respect to the State Implementation Plan (SIP).

The staff has reviewed the requirements of AB 2637 and has investigated the emissions impact of increasing the Smog Check exemption to either five or six model years for new motor vehicles. The analyses show that significant, adverse emissions impacts would result in Enhanced Smog Check areas from increasing the exemption to either five or six model years. Therefore, the staff proposes that the Board approve its report and find that a fleet-wide exemption for new motor vehicles beyond the current four years would result in adverse emission impacts that would prohibit the State from meeting California's SIP commitments in Enhanced Smog Check areas. In Basic Smog Check areas, the staff proposes that the Board find the exemption would not prohibit the State from meeting California's SIP commitments. If the Board approves the findings proposed by staff, the exemption would not increase beyond the current four years in Enhanced Smog Check areas, but would increase to five and six model year vehicles in Basic Smog Check areas. As indicated in the report, ARB staff also suggests that further investigation is warranted to determine if subgroups of cleaner five and six year old vehicles can receive an extended exemption period in Enhanced Smog Check areas from their initial Smog Check inspection, with minimal adverse emission impacts.

ARB staff will present a written report at the meeting. Copies of the report may be obtained from the Board's Public Information Office, 1001 "I" Street, 1st Floor, Environmental Services Center, Sacramento, CA 95814, (916) 322-2990, after April 2, 2003. The report may also be obtained from ARB's internet site at **[http://www.arb.ca.gov/msprog/inusecom/inusecom.htm]**.

Interested members of the public may also present comments orally or in writing at the meeting, and in writing or by e-mail before the meeting. To be considered by the Board, written comments submissions not physically submitted at the meeting must be received **no later than 12:00 noon, April 23, 2003,** and addressed to the following:

Postal mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 "I" Street, 23rd Floor
Sacramento, California 95814

Electronic mail is to be sent to **smogck03@listserv.arb.ca.gov** and received at the ARB **no later than 12:00 noon, April 23, 2003.**

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB **no later than 12:00 noon April 23, 2003.**

The Board requests, but does not require 30 copies of any written submission. Also, the ARB requests that written and e-mail statements be filed at least 10 days prior to the meeting so that ARB staff and Board members have time to fully consider each comment. Further inquiries regarding this matter should be directed to Tony Dickerson, Air Resources Engineer, (626) 459-4350, 9528 Telstar Avenue, El Monte, CA 91731.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

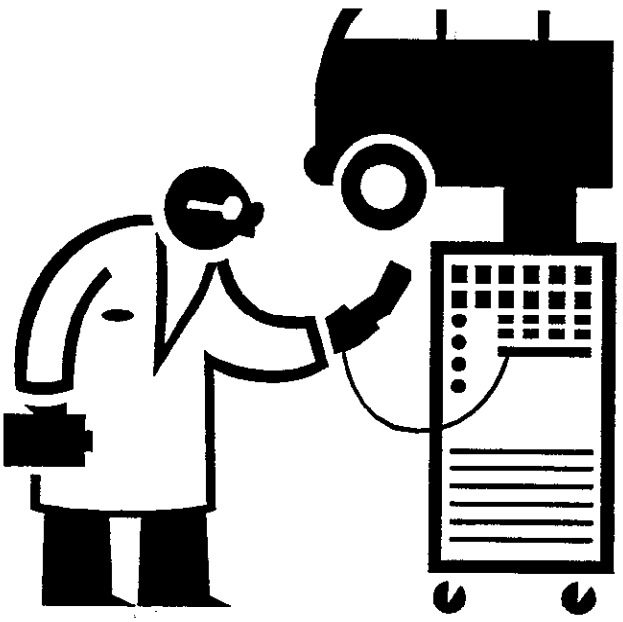
Date:

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at www.arb.ca.gov.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

STAFF REPORT

THE EXEMPTION OF ADDITIONAL VEHICLES FROM SMOG CHECK



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 the mention of trade names or commercial products constitute endorsement or recommendation for use.

Date of Release: April 2, 2003
Scheduled for Consideration: April 24, 2003

EXECUTIVE SUMMARY

Assembly Bill 2637 (Stats. 2002, Chapter 1001), signed by the Governor in September 2002, establishes an Enhanced Smog Check program in the San Francisco Bay Area Air Basin. As part of the law, the current four-year Smog Check exemption for new motor vehicles would be extended statewide to six years with the goal of minimizing the burden of the program on vehicles less likely to fail an inspection. The increased exemption is to become effective in all Basic and Enhanced Smog Check areas unless the ARB finds that exempting the additional vehicles would prohibit the State from meeting the requirements of the section 176(c) of the federal Clean Air Act or California's commitments with respect to the State Implementation Plan (SIP).

This report presents an analysis conducted to examine the impact of the proposed expanded exemption. It is intended to provide the Board with the information it needs to make the air quality impact finding called for in AB 2637.

The results of the analysis are that either a five or six year exemption for new vehicles would result in a significant increase in ozone forming emissions throughout areas designated for the Enhanced Smog Check Program. The magnitude of the increase would present a significant barrier towards achievement of California's air quality commitments. Therefore, the staff proposes that the Board approve its report and find that a fleet-wide exemption for new motor vehicles beyond the current four years would result in adverse emission impacts that would prohibit the State from meeting California's SIP commitments in Enhanced Smog Check areas. In Basic Smog Check areas, the staff proposes that the Board find the exemption would not prohibit the State from meeting California's SIP commitments.

If the Board approves the findings proposed by staff, the exemption would not increase beyond the current four years in Enhanced Smog Check areas, but would increase to five and six model year vehicles in Basic Smog Check areas. In addition, as explained in the body of this report, staff believes opportunities may exist in Enhanced Smog Check areas for more targeted newer vehicle exemptions focusing on vehicles determined to be far less likely to benefit from an initial inspection after four years in comparison to the overall five and six year old fleet.

BACKGROUND

Assembly Bill 2637, by Assemblyman Dennis Cardoza (D-Merced), was passed by the Legislature August 28, 2002, and was signed by Governor Davis on September 27, 2002. The measure took effect January 1, 2003.

AB 2637 requires the establishment of an Enhanced Smog Check Program in the urbanized areas of the San Francisco Bay Area Air Basin (Bay Area). The Bay Area Air Basin includes the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara, and portions of Solano and Sonoma. The Enhanced Smog Check Program includes loaded-mode (dynamometer-based) testing, as well as the direction of selected vehicles to Test-Only stations in the urban parts of these counties.

The bill requires the Bureau of Automotive Repair (BAR) to launch the enhanced program in the Bay Area once an adequate number of test-only stations, test and repair stations, referee services, and other necessary facilities and equipment are in place to provide reliable and convenient service to vehicle owners. BAR's goal is to have licensed Smog Check stations begin testing vehicles in the Bay Area using the BAR-97 test instrument platform by July 1, 2003. Dynamometer-based testing is scheduled to begin October 1, 2003.

In addition to the above, AB 2637 amends Section 44011(a)(4)(B) of the California Health and Safety Code to extend the new vehicle exemption from the state's Smog Check Program for up to an additional two years (i.e. for the first six years instead of just four). The model year exemption for new vehicles does not apply upon change of ownership or if a vehicle is being registered in California for the first time. Any motor vehicle that is 30 or more model-years old is exempt from Smog Check.

The additional two year exemption for the biennial Smog Check Program was included in the law based on a preliminary emissions analysis which indicated that the reduction in Smog Check emission benefits might not be significant. The increased exemption is to become effective in all basic and enhanced Smog Check areas beginning January 1, 2004, unless the ARB finds that exempting the additional vehicles would prohibit the State from meeting the requirements of the section 176(c) of the federal Clean Air Act or California's commitments with respect to the State Implementation Plan.

Since the enactment of the legislation, a detailed analysis of the emissions impact of extending the new vehicle exemption from four to six years in Enhanced Smog Check areas has been performed by a consultant. This report summarizes the results of the analysis, and the staff's recommendations on the appropriateness of proceeding with increased new vehicle exemptions.

IMPACT OF EXEMPTING FIVE AND SIX YEAR OLD VEHICLES

The consultant analyzed currently available data to estimate the loss in emission benefits expected to occur as a result of extending the new vehicle exemption. Both exhaust and evaporative emissions impacts were considered in the evaluation. The analysis focused on those areas of the state with Enhanced I/M Acceleration Simulation Mode (ASM) dynamometer testing already in place or expected by January 2004 (and thus includes the San Francisco Bay Area). As discussed in the Technical Support Document (TSD), the detailed data analyzed were derived from several sources.

The primary source of data was approximately 13,000 emission tests collected statewide during random pull-over inspections conducted by BAR. These data were collected from 2000 through 2002, and included dynamometer emission tests at the roadside and physical inspections of the vehicles. An additional 2,000 emission tests performed at the ARB's Haagen-Smit Laboratory were also used in the analysis.

Analysis of data obtained from Arizona and Wisconsin's inspection programs confirmed the exhaust failure rates observed in California's roadside data. Data from Arizona's evaporative pressure tests were used directly in calculating evaporative emission rates (California has not yet implemented an evaporative pressure test; this analysis assumes that California will have an low pressure evaporative test in place before 2005 that is at least as effective as Arizona's). For 1995 and newer vehicles subject to the enhanced evaporative test procedures, pre-inspection failure rates were based on an analysis of the OBD II roadside data.

The analysis of the data was performed in calendar year 2002. Emission rates from all tests were used to create an overall baseline fleet emission value. By identifying those five and six year old vehicles (1998 and 1997 models) that would fail a smog inspection, fleet emission rates with and without five and/or six year old vehicles exempted from inspections were calculated. The difference in fleet emission rates as a percentage increase was applied to the baseline ton per day (tpd) emission results calculated by the EMFAC2002 model to determine the statewide loss of emission reductions from exempting five and six model year vehicles from inspections. The analysis methodology is similar to the approach that staff used in the July 2000 evaluation of the Smog Check II program.

The analysis assumes that the exempt vehicles would still be subject to a change of ownership inspection. A 17 percent annual change of ownership rate was used in the analysis.

Exemption Results

The results indicate that extending the new vehicle exemption for an additional one or two more years is projected to significantly increase vehicle emissions in Enhanced I/M areas. Exempting both five and six year old vehicles will increase emissions by about four tpd of ROG and NOx in 2005. Exempting only five year old vehicles would

increase 2005 calendar year emissions by nearly two tpd in Enhanced I/M areas. The results of the analysis are presented in Table 1.

The emission increases resulting from additional Smog Check exemptions are lower in 2010 due to the lower baseline emission levels. However, a five or six year exemption is still estimated to increase ozone-forming emissions by one to three tpd, respectively.

Table 1 - Emissions Impact from Five and Six year Smog Check Exemption**

	Enhanced Area Emissions (tons per day)					
	Reactive Organic Gases (ROG)			CO	NOx	ROG+NOx
	Exhaust	Evap.	Total			
2005 Baseline *	259	242	501	5,013	507	1,008
Increase: 5 year exempt.	0.10	0.59	0.69	4.95	1.08	1.77
Increase: 6 year exempt.	0.51	1.19	1.70	13.12	2.01	3.71
2010 Baseline *	167	194	361	3507	344	705
Increase: 5 year exempt.	0.07	0.47	0.54	3.44***	0.73	1.27
Increase: 6 year exempt.	0.33	0.95	1.28	9.18	1.36	2.64

*Baseline - Light-Duty Vehicles subject to Smog Check
**Some exact values rounded to preserve table integrity.
***The originally stated value was 3044 tpd, the correct value is 3.44 tpd.

Costs and Cost Effectiveness

Using average Smog Check inspection and repair costs, the total cost of retaining five and/or six year old vehicles in the enhanced program was analyzed. These costs were then compared to the corresponding emission benefits of five and six year inspections to determine the cost effectiveness of keeping these vehicles in the program. The results are summarized in Table 2.

Table 2 - Five and Six Year Smog Check Costs and Cost Effectiveness

	Retain Five Year Old Vehicles	Retain Six Year Old Vehicles
Total Annual Costs ($ millions)	63	122
ROG and NOx benefits (tons / I/M cycle)	1,416	2,709
Cost Effectiveness	$44,324 / ton	$44,858 / ton

The cost effectiveness of allowing a five or six model year exemption is at the high end compared to past emission control measures. However, the staff anticipates that further on-road control strategies intended to make up the benefits lost through added

exemptions would be hard to achieve in a comparable cost-effective manner. Further, realization of the benefits would be delayed until the new control measures took effect. As discussed below, these emission reductions are critical for meeting California's air quality goals.

IMPLICATIONS ON THE SIP

In November 1994, California submitted to the U.S. Environmental Protection Agency (U.S. EPA) a comprehensive SIP, detailing how six areas of the state -- San Diego County, the San Joaquin Valley, Ventura County, the Sacramento Region, the Southeast Desert, and the South Coast -- would attain the one-hour federal ozone standard by the statutory deadlines. Enhanced Smog Check was a critical element of the 1994 SIP; in fact, it was responsible for a quarter of the emission reductions needed by 1999. San Diego and Ventura are relying on the full benefits of the Enhanced program in place today; the South Coast, San Joaquin Valley, Southeast Desert, and Sacramento need further reductions from the program to help attain this standard.

The Bay Area is transitioning from Basic to Enhanced Smog Check under the provisions of AB 2637. The SIP for this region includes a State commitment for additional emission reductions through a more effective Smog Check program that the one in place today.

In addition to being a key strategy for attaining the one-hour ozone standard, Smog Check will also be important in helping the State attain the new, more stringent federal standards for eight-hour ozone and fine particulate matter. California will also rely on Smog Check to help maintain progress toward State air quality standards.

In July 2000, the ARB and the BAR released a report that concluded Enhanced Smog Check was achieving emission reductions, but was not fully meeting the SIP commitment. In August 2000, the ARB and the BAR committed to implement additional Smog Check improvements to remedy the shortfall. The ARB and the BAR have yet to implement all the Smog Check improvements committed to in August 2000. Consequently, in order to meet the existing Enhanced Smog Check SIP commitment, California must preserve and improve the program.

The ARB is scheduled to act on a number of SIP revisions in the next year, including the 2003 South Coast SIP for ozone and particulate matter. The draft 2003 South Coast SIP contains defined State and local control measures to cut emissions, as well as a broad commitment to achieve an additional 350 tpd of ROG and NOx reductions by 2010. Even control measures that achieve about one-tenth of a tpd, or less, are being considered. Achieving the additional 350 tpd of reductions by the 2010 attainment deadline will pose a significant challenge to the ARB, South Coast Air Quality Management District, Southern California Association of Governments, and U.S. EPA.

The ARB also expects to act on a new San Joaquin Valley Air District ozone SIP within the next year. Like the South Coast SIP, the San Joaquin Valley plan is expected to contain ambitious targets for ROG and NOx emission reductions. According to

preliminary estimates, staff expects that the plan will require approximately a 30 percent overall reduction in ROG and NOx emissions.

In conclusion, exempting five and six year old vehicles from the Enhanced program would prevent the State from meeting its Smog Check SIP commitment and make it harder to show attainment of air quality standards in areas such as the South Coast and San Joaquin Valley. The staff believes any lost benefit on the order of one tpd or more would be unacceptably large, given the need to achieve every feasible emission reduction from this program.

However, the exemption for five and six year old vehicles could be extended in Basic Smog Check program areas without jeopardizing the existing SIP. Basic Smog Check is currently in place in most other areas of the state with lower pollution and population. Many of these areas have already attained the federal one-hour ozone standard (as well as the carbon monoxide standard). These regions are covered by SIPs demonstrating how they will maintain compliance with the standards for the next decade. For example, the maintenance SIPs for Santa Barbara, Monterey, and Lake Tahoe include the Basic Smog Check program, but the benefits from other adopted ARB regulations would ensure that the State continues to meet its SIP obligations even if the Basic program exemption is extended to five and six model year vehicles. For Basic Smog Check areas, therefore, the staff is not able to find that providing an exemption for five and six model year vehicles would prohibit the State from meeting California's SIP commitments, as specified in Health and Safety Code Section 44011(a)(4)(B).

OPTIONS TO MITIGATE IMPACT

Although the projected adverse emissions impact of a fleet-wide five or six year new vehicle exemption is unacceptably large, the staff believes that more limited additional exemptions within the population of five and six year old vehicles may be warranted. It may be possible to identify subsets of the five to six year old vehicle fleet that will not benefit significantly from their initial smog check, based on demonstrated emissions durability and other factors. Possible examples are discussed below.

- **Partial Zero Emission Vehicles (PZEV)**

PZEV certified engine families are a good example of vehicles that should exhibit very limited benefits from a Smog Check in the five to six year time frame. To be certified as a PZEV, a vehicle must meet the ARB's stringent exhaust emission standards, have zero evaporative emissions, and be covered by an emissions warranty for 15 years or 150,000 miles, whichever comes first. These vehicles have fully functioning OBD II systems, which will identify virtually all causes of excess emissions. Vehicle owners will be notified of emission-related malfunctions through a dashboard warning light. Because emission-related repairs for PZEV vehicles will be covered under warranty through the exemption period, unlike conventional vehicles, it is expected that most vehicle owners will seek prompt repair of problems that occur. Thus, the benefit of a Smog Check while these vehicles are under warranty is expected to be minimal.

The number of PZEV vehicles available for sale in California is becoming significant. For the 2003 model year, seven manufacturers have certified a total of eight PZEV models. According to 2003 projected sales information provided by these manufacturers, total 2003 PZEV production is expected to be approximately 140,000 in California. PZEV production in future model years is expected to continue to increase. Because the PZEV category is essentially new with the 2003 model year, the added exemption for these vehicles wouldn't actually begin until calendar year 2007. For this reason, the staff recommends that a decision on exempting five and six year old PZEV vehicles from Smog Check be deferred until in-use experience with these vehicles is available.

- **Using Remote Sensing Technologies to Identify Low Emission Vehicles**

The ARB and the BAR are developing a pilot study to assess the effectiveness of remote sensing technology as a supplemental tool to enhance California's I/M Program. Remote sensing technology will be evaluated to determine if it is effective in identifying individual or groups of low emitting vehicles. If effective, these vehicles could be exempted from their fifth or sixth year inspection. The ARB released its "Request For Proposals" for a contract to carry out this study earlier this year. The study will be completed by May 2005.

- **Profiling Vehicles Based on BAR's Database**

Another possible way to exempt vehicles is to identify lower emitting five and six year old models at the manufacturer level. The BAR database can be used to identify manufacturer-specific models that have historically had extremely high inspection pass rates. This could be an indicator that newer models using similar engine and emission controls would also have high pass rates, and could skip an inspection cycle without a significant loss in emissions benefit. The BAR has begun evaluating this approach, and could implement additional exemptions on a pilot basis in 2004.

RECOMMENDATION

The staff has reviewed the requirements of AB 2637 and has investigated the emissions impact of increasing the Smog Check exemption to either five or six model years for new motor vehicles. The analyses show that significant, adverse emissions impacts would result in Enhanced Smog Check areas from increasing the exemption to either five or six model years. Therefore, the staff proposes that the Board approve its report and find that a fleet-wide exemption for new motor vehicles beyond the current four years would result in adverse emission impacts that would prohibit the State from meeting California's SIP commitments in Enhanced Smog Check areas. In Basic Smog Check areas, the staff proposes that the Board find the exemption would not prohibit the State from meeting California's SIP commitments. If the Board approves the findings proposed by staff, the exemption would not increase beyond the current four years in Enhanced Smog Check areas, but would increase to five and six model year vehicles in Basic Smog Check areas.

Although the staff has concluded that an exemption from Smog Check of all five or six year old vehicles would increase emissions, staff believes that exemptions of a subset of these vehicles may be possible in Enchanced Smog Check areas with reduced adverse emission impacts. For example, it may be possible to exempt certain groups of vehicles (such as PZEV) whose emission characteristics and extended warranty period suggest few vehicles would fail an inspection. It may also be possible to exempt individual vehicles, or groups of vehicles, based on roadside measurements or based on historical records collected by the BAR. Studies are underway to establish the effectiveness of these approaches.

THE EXEMPTION OF ADDITIONAL VEHICLES FROM SMOG CHECK

TECHNICAL SUPPORT DOCUMENT

RELEASE DATE: April 2, 2003

THE STATE OF CALIFORNIA
AIR RESOURCES BOARD

1. ENVIRONMENTAL IMPACTS

This section of the report summarizes the emissions impacts of exempting five- and six-year old vehicles from the Smog Check Program in enhanced areas. Key assumptions and the modeling approach used in the analysis are also presented.

1.1 Introduction

As amended under AB2637, Section 44011(a)(4)(B) of the California Health and Safety Code provides for newer vehicles to be exempted from the state's Inspection and Maintenance (I/M) program for an additional two years (for the first six years instead of just four years) beginning January 1, 2004. However, this extension of the model year exemption is contingent upon a finding by the Air Resources Board that it will not prohibit the state from meeting State Implementation Plan (SIP) commitments.

Analysis of currently available data from several different sources was performed to estimate the loss in emission benefits expected to occur as a result of extending the new vehicle exemption; both exhaust and evaporative emissions impacts were considered in the evaluation. The analysis focused on those areas of the state with Enhanced I/M Acceleration Simulation Mode (ASM) testing already in place or expected by January 2004 (and thus includes the San Francisco Bay Area).

The first step in the analysis was to establish baseline emission factors versus vehicle age that reflect the current I/M program. This was based on an evaluation of "random roadside" emissions data collected by the Bureau of Automotive Repair (BAR) in which vehicles were pulled over at various locations throughout the state and given an emissions test. Emission rates of vehicles 5 and 6 years old were then adjusted to reflect a non-I/M case. Comparing the fleet-average emissions of the non-I/M scenario (for 5- and 6-year old vehicles) to the baseline case provided an estimate of the percentage increase in emissions as a result of exempting 5- and 6-year old vehicles. These percentage increases were applied to the baseline ton per day emissions results calculated by the EMFAC2002 model to determine the statewide impact of exempting five- and six-year old vehicles from the Smog Check program. This is similar to the approach that staff used in the July 2000 evaluation of the Smog Check II program.[1]

1.2 Baseline Emission Factors – Exhaust Emissions

As noted above, random roadside data collected by BAR were used to establish the baseline hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) emission factors for this evaluation. Those data, which were collected during calendar years 2000 through 2002, consist of approximately 13,000 test records. However, because the roadside test consisted of the steady-state ASM test that is used in the Enhanced Smog Check program, it was necessary to adjust those data to reflect stop-and-go driving as reflected in the Federal Test Procedure (FTP) for light-duty vehicles. This was done with correlation equations that predict FTP scores based on a vehicle's performance on the ASM test. The correlation equations used in this analysis were

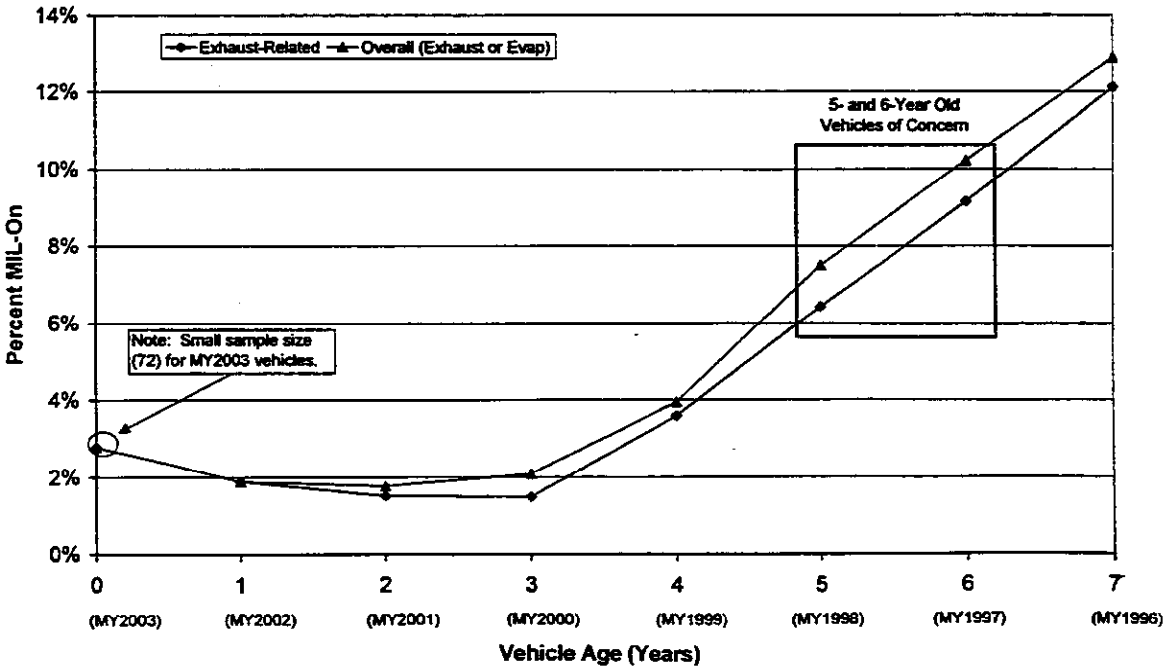
developed from a sample of nearly 2,000 vehicles that had received both FTP and ASM tests at ARB's Haagen-Smit Laboratory. The methodology used to develop the correlation equations was consistent with the approach used in the July 2000 Smog Check II Evaluation,[2] but was updated with additional data on newer vehicles.

The roadside data were analyzed as a calendar year 2002 fleet. Thus, five and six year old roadside vehicles refer to 1998 and 1997 model years, respectively. Because the roadside data were collected at various locations in California over a period of two to three years, some of the vehicles had not been subject to the ASM test procedure. Thus, those vehicles were removed from the database so that the baseline factors would reflect average emissions from vehicles that had been subject to the Smog Check II program. This approach was used for 1996 and older model year vehicles to reflect "After I/M" emissions. Note that for the five- and six-year exemption analysis, a "No I/M" case was also required only for vehicles six years old and newer. Thus, there was no need to develop a non-I/M estimate for the 1996 and older model year vehicles.

As a result of small sample sizes for 1997 and newer model year vehicles, a slightly different approach was used to establish After-I/M and No I/M emission rates. In a separate roadside test program conducted during the fall of 2002, BAR pulled over a random sample of approximately 2,000 1996 and newer model year vehicles equipped with second-generation On-Board Diagnostic systems (OBD II). In that program, the vehicle computer was queried to determine the presence of diagnostic trouble codes (DTCs), and the condition of the malfunction indicator light (MIL) was recorded (i.e., whether or not the MIL was "commanded on," and therefore indicative of the presence of an emissions control system problem). A summary of the exhaust-related and overall MIL-on rates as a function of model year is shown in Figure 1.1 for this test program.

Figure 1.1

MIL-On Rates Observed in the Fall 2002
California Random Roadside Test Program



As observed in Figure 1.1, there is a fairly moderate MIL-on rate for vehicles that are three-years old and newer (i.e., less than 2% except for model year 2003 vehicles in the figure; however, that is a result of the small sample size for those vehicles in this particular test program). After three years of age, the MIL-on rates increase substantially. This pattern is consistent with data from other programs, and it is thought to be a result of the expiration of the 3-year, 36,000-mile "bumper-to-bumper" warranty. For example, Table 1.1 summarizes overall MIL-on rates as a function of vehicle mileage for vehicles in the Arizona I/M program and the Wisconsin I/M program. Both programs show a large increase in MIL-on rates beyond about 40,000 miles, consistent with the failure rates observed in the California roadside data shown in Figure 1.1. (Note that the Arizona and Wisconsin data were not used in the emissions calculations that follow; they are presented here for comparison to the California roadside MIL-on rates.)

Table 1.1
Summary of MIL-On Rates vs. Vehicle Mileage in the
Arizona and Wisconsin I/M Programs

Mileage Interval	Arizona Program		Wisconsin Program	
	Ave Odom.	MIL-On	Ave Odom.	MIL-On
0 - 25,000	16,900	2.2%	14,400	0.4%
25,000 - 50,000	40,300	2.3%	37,000	1.1%
50,000 - 75,000	63,300	4.0%	60,700	2.9%
75,000 - 100,000	86,800	6.3%	85,400	5.6%
100,000 - 125,000	111,100	10.6%	110,600	8.2%
> 125,000	152,000	15.4%	150,500	12.0%

Using the MIL-on rates observed in the California OBD II roadside data collected in the fall of 2002 (i.e., Figure 1.1) in conjunction with: (1) the average emissions from the California ASM roadside data (converted to an FTP basis), and (2) FTP emissions from MIL-on vehicles tested in EPA[3] and U.C. Riverside[4] test programs, it was possible to estimate passing vehicle emission rates (reflecting After I/M emissions) for the 1997 and newer model year vehicles. The No I/M emission rates for this group of vehicles were based on 1999 to 2002 model year vehicles in the ASM roadside data that had not yet been through the I/M program. A flowchart of the analysis steps and data sources used to develop model-year specific FTP emission rates is shown in Figure 1.2, and the resulting FTP-based emission factors, incorporating the adjustments described above, are summarized in Table 1.2.

Figure 1.2

Flowchart of Analysis Steps and Data Sources Used to Develop Model-Year Specific FTP-Based Emission Rates

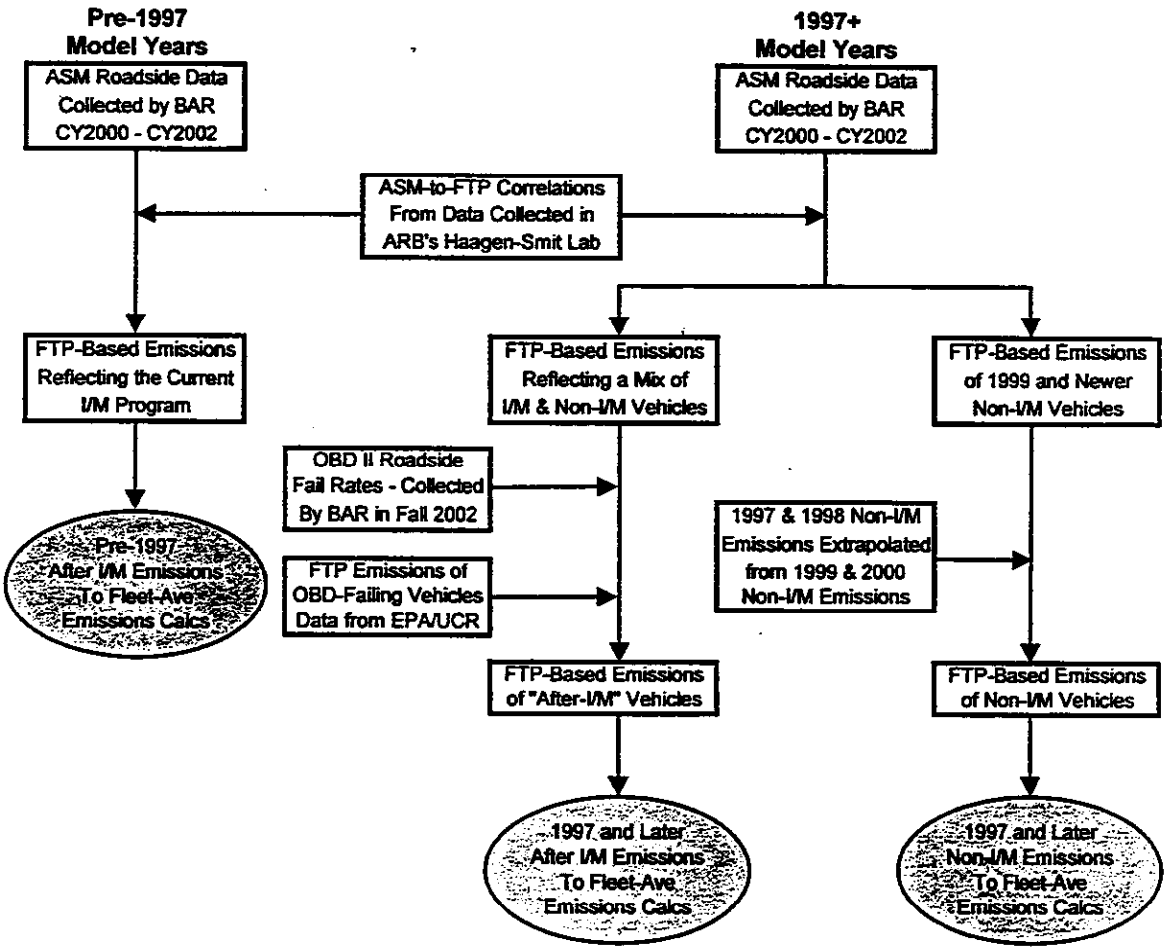


Table 1.2

FTP-Based Emission Rates for the California Light-Duty Vehicle Fleet Based on BAR Random Roadside Testing

Model Year	Age	EMFAC VMT Frac	No I/M Emissions (g/mi)			BAR-97 I/M Emissions (g/mi)		
			HC	CO	NOx	HC	CO	NOx
1971	32	0.0116				10.25	123.49	3.52
1972	31	0.0014				8.47	91.53	3.32
1973	30	0.0011				8.38	90.30	3.05
1974	29	0.0016				8.24	73.46	2.75
1975	28	0.0023				3.85	49.83	2.92
1976	27	0.0028				4.61	60.94	2.46
1977	26	0.0033				4.16	44.33	2.30
1978	25	0.0026				3.79	46.16	1.96
1979	24	0.0032				3.00	33.24	1.91
1980	23	0.0041				1.99	29.00	1.73
1981	22	0.0053				1.66	24.75	1.62
1982	21	0.0092				1.92	24.09	1.51
1983	20	0.0124				1.56	21.49	1.49
1984	19	0.0167				1.43	20.74	1.46
1985	18	0.0199				1.31	18.16	1.34
1986	17	0.0236				1.10	15.07	1.26
1987	16	0.0295				0.96	13.31	1.14
1988	15	0.0305				0.75	10.02	1.03
1989	14	0.0340				0.63	8.64	0.91
1990	13	0.0325				0.54	7.20	0.82
1991	12	0.0385				0.49	6.88	0.74
1992	11	0.0439				0.42	5.79	0.68
1993	10	0.0522				0.33	4.88	0.55
1994	9	0.0482				0.28	4.07	0.54
1995	8	0.0577				0.21	3.20	0.44
1996	7	0.0592				0.18	2.65	0.35
1997	6	0.0661	0.157	2.206	0.314	0.140	1.982	0.294
1998	5	0.0673	0.140	2.012	0.277	0.136	1.880	0.254
1999	4	0.0700	0.123	1.818	0.240	0.120	1.699	0.237
2000	3	0.0757	0.106	1.624	0.203	0.105	1.572	0.201
2001	2	0.0835	0.096	1.451	0.172	0.094	1.397	0.170
2002	1	0.0904	0.092	1.386	0.186	0.090	1.316	0.183

1.3 Baseline Emission Factors – Evaporative Emissions

Model-year specific evaporative emissions estimates, i.e., running loss, hot soak, diurnal, and resting loss emissions, were also calculated for individual model years. For this analysis, EPA's MOBILE6 model was used to estimate separate gram-per-mile emission rates for vehicles passing and failing a functional evaporative system check. MOBILE6 was used in this evaluation because it distinguishes between vehicles that pass and fail a functional evaporative system check, and BAR has indicated that it intends to incorporate an evaporative check in the Smog Check program in the future (in addition to the current gas cap check). Emissions estimates were also calculated independently for vehicles

subject to the enhanced evaporative test procedures versus those that were certified to the one-hour SHED test.

Once emission rates for passing and failing vehicles were determined, it was necessary to estimate in-use evaporative failure rates as a function of model year and vehicle age. For pre-1995 vehicles that were certified to the one-hour SHED test, pre-inspection evaporative system failure rates were based on data collected in the Arizona I/M program during the first I/M cycle after pressure testing had been implemented in that program;[5] gas cap only failures were also based on an analysis of Arizona I/M data to be consistent with the pressure test data. For 1995 and newer vehicles subject to the enhanced evaporative test procedures, pre-inspection failure rates were based on an analysis of the OBD II roadside data (Figure 1.1). Evaporative system failure rates were determined by reviewing the OBD II fault codes recorded for vehicles with the MIL on in the roadside test program. Table 1.3 summarizes the evaporative system defect rates from the roadside data. Because of the relatively small sample size of 1997 and 1998 model year vehicles (i.e., five- and six-year old vehicles), the two model years were combined to establish the evaporative system failure rates for these model years. Because of the phase-in of enhanced evaporative emission standards, few 1996 model year vehicles in the roadside data were certified to those standards.

Table 1.3
Summary of Evaporative System Defects in the Fall 2002 OBD II Roadside Test Program for Vehicles Certified to the Enhanced Evaporative Test Procedures

Model Year	Vehicle Age	Average Odometer	Total Count	Evap-Related MILs MIL On	% MIL
1996	7	101729	49	0	0.0%
1997	6	104194	122	1	0.8%
1998	5	75129	272	5	1.8%
1999	4	61778	277	2	0.7%
2000	3	43207	333	3	0.9%
2001	2	31125	392	2	0.5%
2002	1	16574	424	0	0.0%
2003	0	6792	72	0	0.0%
1997+1998			394	6	1.5%

To account for the impact of an I/M test on failure rates of pre-enhanced evaporative vehicles, it was assumed that 90% of the identified pressure test failures were repaired and 95% of the identified gas cap failures were repaired. Vehicles certified to enhanced evaporative test procedures were assumed to have 95% of the defects identified by the OBD II system repaired. A summary of No I/M and After I/M evaporative emission rates for calendar year 2005 is shown in Table 1.4.

Table 1.4
Evaporative Emission Rates for "No I/M" and "After I/M" Scenarios

Vehicle Age	Model Year	EMFAC VMT Frac	No I/M (g/mi)	After I/M (g/mi)
25	1981+	0.0264	0.927	0.751
24	1982	0.0032	0.871	0.696
23	1983	0.0041	0.778	0.602
22	1984	0.0053	0.691	0.517
21	1985	0.0092	0.599	0.438
20	1986	0.0124	0.516	0.378
19	1987	0.0167	0.444	0.327
18	1988	0.0199	0.378	0.284
17	1989	0.0236	0.320	0.245
16	1990	0.0295	0.267	0.209
15	1991	0.0305	0.252	0.200
14	1992	0.0340	0.239	0.193
13	1993	0.0325	0.227	0.187
12	1994	0.0385	0.216	0.183
11	1995	0.0439	0.191	0.167
10	1996	0.0522	0.155	0.136
9	1997	0.0482	0.122	0.107
8	1998	0.0577	0.055	0.046
7	1999	0.0592	0.052	0.045
6	2000	0.0661	0.049	0.043
5	2001	0.0673	0.047	0.041
4	2002	0.0700	0.042	0.039
3	2003	0.0757	0.039	0.036
2	2004	0.0835	0.030	0.028
1	2005	0.0904	0.020	0.020

1.4 Model Year Exemption Results

Using the emission factors from Tables 1.2 and 1.4, fleet-average emissions were calculated by applying the EMFAC-based travel fraction for each model year to the emission rates for each model year. Summing over all model years results in an estimate of fleet-average emissions. To estimate the impacts of model year exemptions, the non-I/M emission rates were applied to the vehicle ages that were assumed to be exempt. Three cases were considered:

- The current 4-year exemption;
- A 5-year exemption; and
- A 6-year exemption.

In all cases it was assumed that the exempt vehicles would be subject to a change of ownership inspection. This was accounted for in the analysis based on a 17% annual change of ownership rate.

The fleet-average emission rates for the three scenarios outlined above were calculated, and the details of those calculations are presented in the spreadsheet listing in Appendix A. The percentage increases resulting from exempting five- and six-year old vehicles were applied to the baseline EMFAC2002 light-duty vehicle emissions for enhanced I/M areas. The results of this analysis are summarized in Table 1.5. As shown in the table, exempting five-year old vehicles is projected to increase ROG+NOx emissions in Enhanced I/M areas by 1.77 tons per day (tpd) in calendar year 2005, or about 0.2% of the light-duty vehicle ROG+NOx inventory. Exempting five- and six-year old vehicles is estimated to increase ROG+NOx emissions by 3.71 tpd in 2005, about 0.4% of the light-duty vehicle ROG+NOx inventory. Increased emissions for all ozone precursors using an emissions weighting scheme of ROG+NOx+(CO÷40) based on relative incremental reactivity between ROG and CO were also determined. Exempting five- and six-year old vehicles are estimated to result in a 4.04 tpd increase in "equivalent ozone-forming potential" emissions in 2005.

Table 1.5
Emissions Impacts from Extending the Current New Vehicle I/M Exemption from Four Years to Five and Six Years Based on EMFAC2002 Baseline Emissions

		Enhanced Area Emissions (tons per day)						
Scenario		ExhROG	EvpROG	TotROG	CO	NOx	ROG+NOx	ROG+NOx +CO/40
Baseline 2005 Results		259.40	242.30	501.68	5012.83	506.77	1008.45	1133.77
Baseline 2010 Results		166.70	193.96	360.66	3507.04	343.90	704.56	792.23
Increase from Baseline:								
CY2005	Exempt 5	0.10	0.59	0.69	4.92	1.08	1.77	1.89
	Exempt 5+6	0.52	1.19	1.70	13.12	2.01	3.71	4.04
CY2010	Exempt 5	0.06	0.47	0.54	3.44	0.73	1.27	1.36
	Exempt 5+6	0.33	0.95	1.28	9.18	1.36	2.64	2.87

Note that similar reductions on a percentage basis are observed in Table 1.5 for calendar year 2010. However, those estimates should be re-evaluated once in-use data become available on LEV II vehicles. It is anticipated that the failure rates for those vehicles, particularly those certified to partial zero emission vehicle (PZEV) standards, will decrease relative to current technology vehicles. As a result, the estimates shown in Table 1.5 for 2010 may overstate the magnitude of the emissions increase associated with exempting five- and six-year old vehicles.

1.5 Cost-Effectiveness Estimates

Cost-effectiveness ratios for extending the model year exemption to either five or six model years were calculated by dividing the lost emission benefits by the cost to test and repair five and six year old vehicles under the I/M program. Since cost-effectiveness ratios are typically calculated when adding rather than relaxing an emission control strategy, the calculations were performed in "reverse order" in which it was assumed that six years were initially exempted. Costs and "gained" benefits from reducing the exemption first to five, then to four model years (from a six year exemption baseline) were applied to compute the cost-effectiveness ratios in a manner consistent with other control strategy analysis.

Average inspection and repair costs for ASM inspections in Enhanced I/M areas were combined with age-specific failure rates and I/M-subject statewide vehicle populations to compute annual costs on a statewide basis to currently test and repair five and six year old vehicles. The failure rates were based on OBD failure rates from BAR's Fall 2002 random roadside data. The cost and vehicle population data were obtained from BAR's published "Executive Summary" I/M statistical reports. These statewide estimates were discounted by a factor of 86% to reflect costs for Enhanced I/M areas only. The costs were further discounted by the Change of Ownership rate to reflect costs triggered by change of ownership inspections that will occur irrespective of model year exemptions. Retained benefits were assumed to exist for an entire two-year biennial I/M cycle.

Table 1.6 summarizes the cost effectiveness ratio calculations described above.

Table 1.6
Cost Effectiveness Ratio Calculation Summary
(Assumes a Six-Year Exemption Baseline)

Parameter	Retain 6 Year Old Vehicles	Retain 5 & 6 Year Old Vehicles
Initial Test Failure Rate (%)	10.2%	8.9%
Average ASM Inspection Cost ($/Test)	$45.77	$45.77
Average ASM Repair Cost ($/Vehicle)	$143.18	$143.18
Average Test Cost Per Vehicle ($)	$60.37	$58.44
I/M Subject Vehicle Population (Enhanced Areas)	1,039,478	2,078,955
Total Annual Cost (millions)	$62.76	$121.50
ROG + NOx Only		
Retained Benefits (tons/I/M cycle)	1415.9	2708.5
Cost Effectiveness Ratio ($/ton)	$44,324	$44,858
ROG + NOx + CO÷40		
Retained Benefits (tons/I/M cycle)	1565.7	2948.2
Cost Effectiveness Ratio ($/ton)	$40,084	$41,211

It shows the cost effectiveness ratios based on gained benefits of both ROG and NOx and all ozone-weighted precursors (ROG + NOx + CO÷40). (The ratios based on ROG and NOx benefits are shown for consistent comparison with other ARB program cost-effectiveness calculations, which are based on ROG and NOx only.) Cost effectiveness ratios based on ROG and NOx were calculated as $44,324/ton and $44,858/ton for retaining six-year old vehicles and five and six year old vehicles, respectively. When CO benefits are included (and discounted by an ozone-weighting factor of 40) the respective ratios are $40,084/ton and $41,211/ton.

2. REFERENCES

[1] "Evaluation of California's Enhanced Vehicle Inspection and Maintenance Program (Smog Check II)," California Environmental Protection Agency, Air Resources Board, July 12, 2000.

[2] "Models for Estimating California Fleet FTP Emissions from ASM Measurements," Draft Report prepared by Eastern Research Group for the California Bureau of Automotive Repair, December 25, 1999.

[3] Gardetto, Edward and Ted Trimble. "Evaluation of On Board Diagnostics for Use in Detecting Malfunctioning and High Emitting Vehicles," U.S. Environmental Protection Agency, EPA420-R-00-013, August 2000.

[4] Durbin, Thomas, et. al. "Evaluation of the Effectiveness of On-Board Diagnostics II (OBD II) in Controlling Motor Vehicle Emissions," Center for Environmental Research and Technology, University of California-Riverside, May 2001.

[5] "Estimating Benefits of Inspection/Maintenance Programs for Evaporative Control Systems," U.S. Environmental Protection Agency, EPA420-P-99-031, November 1999.

APPENDIX A

Five and Six Year Exemptions Analysis Spreadsheet

Sample Size and Average FTP Emissions (g/mi) by Model Year and I/M Status
Based on 2000-2002 California Random Roadside ASM Data Regressed to FTP Using New ERG Regressions and OBD Model Failing Vehicle Emissions to Generate No I/M Emissions

Model		EMFAC	Data	No I/M Emissions (g/mi)					BAR-97 I/M Emissions (g/mi)				
Year	Age	VMT Frac	Source	ExhHC	EvpHC	TotHC	CO	NOx	ExhHC	EvpHC	TotHC	CO	NOx
1971	32	0.0116	Road-All						10.250	0.751	11.001	123.491	3.516
1972	31	0.0014	Road-All						8.468	0.751	9.219	91.532	3.323
1973	30	0.0011	Road-All						8.379	0.751	9.130	90.295	3.050
1974	29	0.0016	Road-B97						8.237	0.751	8.988	73.456	2.752
1975	28	0.0023	Road-B97						3.846	0.751	4.597	49.833	2.919
1976	27	0.0028	Road-B97						4.614	0.751	5.365	60.942	2.463
1977	26	0.0033	Road-B97						4.163	0.751	4.914	44.330	2.300
1978	25	0.0026	Road-B97						3.785	0.751	4.536	46.160	1.961
1979	24	0.0032	Road-B97						3.002	0.696	3.698	33.236	1.913
1980	23	0.0041	Road-B97						1.986	0.602	2.588	29.004	1.732
1981	22	0.0053	Road-B97						1.662	0.517	2.179	24.752	1.621
1982	21	0.0092	Road-B97						1.918	0.438	2.356	24.093	1.506
1983	20	0.0124	Road-B97						1.562	0.378	1.940	21.491	1.489
1984	19	0.0167	Road-B97						1.425	0.327	1.752	20.740	1.463
1985	18	0.0199	Road-B97						1.305	0.284	1.589	18.160	1.343
1986	17	0.0236	Road-B97						1.096	0.245	1.341	15.066	1.256
1987	16	0.0295	Road-B97						0.956	0.209	1.165	13.313	1.142
1988	15	0.0305	Road-B97						0.750	0.200	0.950	10.023	1.025
1989	14	0.0340	Road-B97						0.628	0.193	0.821	8.644	0.909
1990	13	0.0325	Road-B97						0.541	0.187	0.728	7.199	0.820
1991	12	0.0385	Road-B97						0.488	0.183	0.671	6.877	0.742
1992	11	0.0439	Road-B97						0.415	0.167	0.582	5.792	0.676
1993	10	0.0522	Road-B97						0.329	0.136	0.465	4.875	0.552
1994	9	0.0482	Road-B97						0.283	0.107	0.390	4.070	0.538
1995	8	0.0577	Road-B97						0.214	0.046	0.260	3.203	0.444
1996	7	0.0592	Road-B97						0.175	0.045	0.220	2.653	0.346
1997	6	0.0661	OBD-Pass	0.157	0.049	0.206	2.206	0.314	0.140	0.043	0.184	1.982	0.294
1998	5	0.0673	OBD-Pass	0.140	0.047	0.187	2.012	0.277	0.136	0.041	0.177	1.880	0.254
1999	4	0.0700	OBD-Pass	0.123	0.042	0.165	1.818	0.240	0.120	0.039	0.159	1.699	0.237
2000	3	0.0757	OBD-Pass	0.106	0.039	0.145	1.624	0.203	0.105	0.036	0.141	1.572	0.201
2001	2	0.0835	OBD-Pass	0.096	0.030	0.126	1.451	0.172	0.094	0.028	0.123	1.397	0.170
2002	1	0.0904	OBD-Pass	0.092	0.020	0.112	1.386	0.166	0.090	0.020	0.110	1.316	0.163
		1.0000											

After I/M Emissions (g/mi) by Model Year and Model Year Exemption Scenario
(emissions are discounted for change of ownership in exempt model years)

Model		EMFAC	Data	Chg Owner%, Year 4 17.0% After Repr Flt (g/mi), Exempt 4					Chg Owner%, Year 5: 17.0% After Repr Flt (g/mi), Exempt 5					Chg Owner%, Year 6 17.0% After Repr Flt (g/mi), Exempt 6				
Year	Age	VMT Frac	Source	ExhHC	EvpHC	TotHC	CO	NOx	ExhHC	EvpHC	TotHC	CO	NOx	ExhHC	EvpHC	TotHC	CO	NOx
1971	32	0.0116	Road-All	10.250	0.751	11.001	123.491	3.516	10.250	0.751	11.001	123.491	3.516	10.250	0.751	11.001	123.491	3.516
1972	31	0.0014	Road-All	8.468	0.751	9.219	91.532	3.323	8.468	0.751	9.219	91.532	3.323	8.468	0.751	9.219	91.532	3.323
1973	30	0.0011	Road-All	8.379	0.751	9.130	90.295	3.050	8.379	0.751	9.130	90.295	3.050	8.379	0.751	9.130	90.295	3.050
1974	29	0.0016	Road-B97	8.237	0.751	8.988	73.456	2.752	8.237	0.751	8.988	73.456	2.752	8.237	0.751	8.988	73.456	2.752
1975	28	0.0023	Road-B97	3.846	0.751	4.597	49.833	2.919	3.846	0.751	4.597	49.833	2.919	3.846	0.751	4.597	49.833	2.919
1976	27	0.0028	Road-B97	4.614	0.751	5.365	60.942	2.463	4.614	0.751	5.365	60.942	2.463	4.614	0.751	5.365	60.942	2.463
1977	26	0.0033	Road-B97	4.163	0.751	4.914	44.330	2.300	4.163	0.751	4.914	44.330	2.300	4.163	0.751	4.914	44.330	2.300
1978	25	0.0026	Road-B97	3.785	0.751	4.536	46.160	1.961	3.785	0.751	4.536	46.160	1.961	3.785	0.751	4.536	46.160	1.961
1979	24	0.0032	Road-B97	3.002	0.696	3.698	33.236	1.913	3.002	0.696	3.698	33.236	1.913	3.002	0.696	3.698	33.236	1.913
1980	23	0.0041	Road-B97	1.986	0.602	2.588	29.004	1.732	1.986	0.602	2.588	29.004	1.732	1.986	0.602	2.588	29.004	1.732
1981	22	0.0053	Road-B97	1.662	0.517	2.179	24.752	1.621	1.662	0.517	2.179	24.752	1.621	1.662	0.517	2.179	24.752	1.621
1982	21	0.0092	Road-B97	1.918	0.438	2.356	24.093	1.506	1.918	0.438	2.356	24.093	1.506	1.918	0.438	2.356	24.093	1.506
1983	20	0.0124	Road-B97	1.562	0.378	1.940	21.491	1.489	1.562	0.378	1.940	21.491	1.489	1.562	0.378	1.940	21.491	1.489
1984	19	0.0167	Road-B97	1.425	0.327	1.752	20.740	1.463	1.425	0.327	1.752	20.740	1.463	1.425	0.327	1.752	20.740	1.463
1985	18	0.0199	Road-B97	1.305	0.284	1.589	18.160	1.343	1.305	0.284	1.589	18.160	1.343	1.305	0.284	1.589	18.160	1.343
1986	17	0.0236	Road-B97	1.096	0.245	1.341	15.066	1.256	1.096	0.245	1.341	15.066	1.256	1.096	0.245	1.341	15.066	1.256
1987	16	0.0295	Road-B97	0.956	0.209	1.165	13.313	1.142	0.956	0.209	1.165	13.313	1.142	0.956	0.209	1.165	13.313	1.142
1988	15	0.0305	Road-B97	0.750	0.200	0.950	10.023	1.025	0.750	0.200	0.950	10.023	1.025	0.750	0.200	0.950	10.023	1.025
1989	14	0.0340	Road-B97	0.628	0.193	0.821	8.644	0.909	0.628	0.193	0.821	8.644	0.909	0.628	0.193	0.821	8.644	0.909
1990	13	0.0325	Road-B97	0.541	0.187	0.728	7.199	0.820	0.541	0.187	0.728	7.199	0.820	0.541	0.187	0.728	7.199	0.820
1991	12	0.0385	Road-B97	0.488	0.183	0.671	6.877	0.742	0.488	0.183	0.671	6.877	0.742	0.488	0.183	0.671	6.877	0.742
1992	11	0.0439	Road-B97	0.415	0.167	0.582	5.792	0.676	0.415	0.167	0.582	5.792	0.676	0.415	0.167	0.582	5.792	0.676
1993	10	0.0522	Road-B97	0.329	0.136	0.465	4.875	0.552	0.329	0.136	0.465	4.875	0.552	0.329	0.136	0.465	4.875	0.552
1994	9	0.0482	Road-B97	0.283	0.107	0.390	4.070	0.538	0.283	0.107	0.390	4.070	0.538	0.283	0.107	0.390	4.070	0.538
1995	8	0.0577	Road-B97	0.214	0.046	0.260	3.203	0.444	0.214	0.046	0.260	3.203	0.444	0.214	0.046	0.260	3.203	0.444
1996	7	0.0592	Road-B97	0.175	0.045	0.220	2.653	0.346	0.175	0.045	0.220	2.653	0.346	0.175	0.045	0.220	2.653	0.346
1997	6	0.0661	OBD-Pass	0.140	0.043	0.184	1.982	0.294	0.140	0.043	0.184	1.982	0.294	*0.154*	*0.048*	*0.202*	*2.168*	*0.311*
1998	5	0.0673	OBD-Pass	0.136	0.041	0.177	1.880	0.254	*0.139*	*0.046*	*0.185*	*1.990*	*0.273*	*0.139*	*0.046*	*0.185*	*1.990*	*0.273*
1999	4	0.0700	OBD-Pass	*0.122*	*0.042*	*0.164*	*1.798*	*0.239*	*0.122*	*0.042*	*0.164*	*1.798*	*0.239*	*0.122*	*0.042*	*0.164*	*1.798*	*0.239*
2000	3	0.0757	OBD-Pass	*0.106*	*0.038*	*0.144*	*1.615*	*0.203*	*0.106*	*0.038*	*0.144*	*1.615*	*0.203*	*0.106*	*0.038*	*0.144*	*1.615*	*0.203*
2001	2	0.0835	OBD-Pass	*0.096*	*0.030*	*0.125*	*1.442*	*0.172*	*0.096*	*0.030*	*0.125*	*1.442*	*0.172*	*0.096*	*0.030*	*0.125*	*1.442*	*0.172*
2002	1	0.0904	OBD-Pass	*0.092*	*0.020*	*0.112*	*1.374*	*0.166*	*0.092*	*0.020*	*0.112*	*1.374*	*0.166*	*0.092*	*0.020*	*0.112*	*1.374*	*0.166*

Calculation of Percentage Impact on Fleet

Scenario	MYs Exempt	Fleet Emission Factor (g/mi) ExhHC	EvpHC	TotHC	CO	NOx
Exempt 4	1999+	0.5677	0.1255	0.6932	7.5051	0.5950
Exempt 5	1998+	0.5679	0.1258	0.6938	7.5125	0.5963
Exempt 6	1997+	0.5688	0.1261	0.6950	7.5247	0.5974
% Change:	4 to 5	0.039%	0.245%	0.076%	0.098%	0.212%
	4 to 6	0.199%	0.490%	0.251%	0.262%	0.396%

California Statewide Fleet Tonnages Under Current (4 MY Exempt) Program

Calendar Year	Statewide Light-Duty Fleet Summer Season Emissions (tons/day) ExhROG	EvpROG	TotROG	CO	NOx	Enhanced Fraction: 86% Enhanced I/M Area Light-Duty Fleet Summer Season Emissions (tons/day) ExhROG	EvpROG	TotROG	CO	NOx
2005	301.63	281.74	583.35	5828.67	599.27	259.40	242.30	501.68	5012.63	506.77
2010	193.84	225.53	419.37	4077.95	399.88	166.70	193.96	360.66	3507.04	343.90

Translation of Model Year Exemption Relative Impacts to Lost Emission Benefits

Calendar Year	Emission Benefits Lost* 5 MY Exemption (tons/day) ExhROG	EvpROG	TotROG	CO	NOx	Emission Benefits Lost* 6 MY Exemption (tons/day) ExhROG	EvpROG	TotROG	CO	NOx	Total ROG+NOx+CO/40 Exempt5	Exempt6
2005	0.181	0.593	0.693	4.924	1.076	0.515	1.187	1.782	13.124	2.805	1.893	4.036
2010	0.065	0.475	0.539	3.445	0.730	0.331	0.950	1.282	9.182	1.361	1.356	2.872

*From a baseline of 4 newest model years exempt

Cost Effectiveness Calculations

Enhanced I/M Area Costs and Failure Rates

	6 MY	5&6 MY	
Initial Test Failure Rate:	10.2%	8.9%	*BAR Oct 2002-Jan 2003 Roadside MIL-On Rates*
Average Inspection Cost:	$45.77	$45.77	*CY2002 Executive Summary Report, ASM Avg Inspection Cost*
Average Repair Cost:	$143.18	$143.18	*CY2002 Executive Summary Report, Average Enhanced Area Repair Cost*
Average Per Vehicle Cost:	$60.37	$58.44	
Vehicles Tested Annually:	1,039,476	2,078,955	*CY2002 Executive Summary Report, 1st Test Volumes x 86% (accounts for SF) x (1-COO)*
Total Annual Cost (millions):	$62.76	$121.50	

Cost Effectiveness (ROG+NOx)

	Exempt 6 to 5	Exempt 6 to 4
Retained Benefits (tons/cycle):	1415.9	2708.5
C/E Ratio:	$44,324	$44,858

Cost Effectiveness (ROG+NOx+CO/40)

	Exempt 6 to 5	Exempt 6 to 4
Retained Benefits (tons/cycle):	1565.7	2948.2
C/E Ratio:	$40,084	$41,211