

**APRIL 2004 EVALUATION OF THE CALIFORNIA ENHANCED  
VEHICLE INSPECTION AND MAINTENANCE  
(SMOG CHECK) PROGRAM**

**Report to the Legislature**

Submitted by:

Air Resources Board  
and  
Department of Consumer Affairs/Bureau of Automotive Repair

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April 2004 Evaluation of California's Enhanced  
Vehicle Inspection and Maintenance (Smog Check) Program

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This report has been reviewed by the staff of the Air Resources Board and the Department of Consumer Affairs Bureau of Automotive Repair and approved for publication.

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**2005 Addendum to the April 2004 Evaluation of the  
California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program Draft  
Report to the Inspection and Maintenance Review Committee**

This 2005 Addendum finalizes the *April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program, Draft Report to the Inspection and Maintenance Review Committee* (Report), and provides an update on what has happened since the draft Report release. The Addendum includes discussion of the Report's public review process, subsequent legislative action including restoration of funding for the Bureau of Automotive Repair's (BAR) vehicle retirement program, and correction of minor errors discovered during the review process.

This finalized report satisfies applicable legislative reporting requirements. Health and Safety Code Section 44003(a)(2) and uncodified Section 15 of Chapter 803 of the Statutes of 1997 require ARB and BAR to jointly report to the Legislature on the status and effectiveness of California's enhanced vehicle inspection and maintenance (Smog Check) program, and make recommendations for improvement by January 2003. Section 15 also directs the California I/M Review Committee (IMRC) to review the program proposed by ARB and BAR and issue its own report to the Legislature by July 1, 2003.

**Public Review Process**

The public has been given an opportunity to review the Report as part of the IMRC review process. The IMRC invited ARB and BAR to present the Report for public comment at three IMRC meetings. On January 27, 2004, prior to the release of the draft Report to the IMRC, ARB and BAR jointly outlined the Report recommendations at an IMRC meeting. After the draft Report was released on April 19, 2004, ARB and BAR jointly presented the full Report and responded to public comment at the IMRC meeting on June 22, 2004. The meeting was noticed on both the IMRC and ARB websites and broadcast via the Internet on ARB's website to increase public participation. The public was able to send questions via email during the meeting. In order to receive public comment on the analysis used to quantify the impacts of the recommendations, ARB and BAR staff also outlined for the IMRC, on May 17, 2004, a technical support document for the Report. This document was released on June 9, 2004. Both the Report and technical support document can be accessed via the ARB website, at [www.arb.ca.gov/msprog/smogcheck/smogcheck.htm](http://www.arb.ca.gov/msprog/smogcheck/smogcheck.htm).

During the public review process, ARB and BAR received five comment letters. Four of these letters raised concerns regarding the number of vehicles directed to test-only stations. This comment topic did not focus on ARB's and BAR's recommendations. One of the four letters conveyed the concern that the Report's recommendations to eliminate the 30-year rolling exemption and annually inspect older vehicles would, if implemented, disproportionately impact classic vehicle and low-income vehicle owners. As indicated in the Report, some motorists would qualify for financial assistance for repairs. At select Smog Check stations, BAR provides financial repair assistance up to \$500, with a \$20 co-payment, for consumers who are considered

low-income. In addition, the vehicles affected by these recommendations are already in the Smog Check inspection program.

The final comment letter conveyed concerns regarding the manner in which the Smog Check benefits and emission reductions were calculated, including the methodology for estimating the benefits from the smog check inspection cycle contained in ARB's emissions estimation model, EMFAC2002. ARB is in the process of updating EMFAC2002 to incorporate the latest available data regarding vehicle population, vehicle emissions, and travel activity. In a response letter, ARB encouraged the commenter to participate in the separate public process for updating the emissions estimation model.

### **Actions by the Legislature and the IMRC Following Release of the Draft Report**

Since the release of the report, the Legislature has passed laws affecting four of the Report's recommendations.

30-Year Rolling Exemption. ARB and BAR recommended eliminating the 30-year rolling exemption and replacing it with a pre-1976 exemption. Governor Schwarzenegger signed AB 2683 (Lieber, Chapter 704, Statutes of 2004) amending State law to replace the 30-year rolling exemption with a pre-1976 exemption effective April 1, 2005. By implementing this recommendation, 5.7 tons per day of smog-forming hydrocarbons (HC) and nitrogen oxides (NOx) will be reduced in the Enhanced areas in 2010.

Clean Screen 5/6 Model-Year Vehicles. The Report also recommended a program to except from biennial inspections clean five and six year old vehicles, model-years one through four were already exempted. SB 1107 (Budget and Fiscal Review Committee, Chapter 230, Statutes of 2004) amended State law beginning January 1, 2005, excepting all vehicles five and six years old from biennial Smog Check inspection. Removing the fifth and sixth model-year vehicles from the biennial Smog Check program will allow an emissions increase of 2.6 tons per day HC and NOx in 2010. However, under SB 1107, the expanded Carl Moyer program will recover these lost benefits ten-fold, as well as provide over \$6 million per year in Smog Check repair assistance to low-income motorists.

Except Two-Year and Newer From Change of Ownership Inspection. ARB and BAR also recommended that vehicles two years old or less be excepted from change of ownership inspections. SB 1107 further amended State law, beginning January 1, 2005, to exempt the first four model years from change of ownership inspection requirements. Exempting the first four model years from change of ownership testing allows an emissions increase of less than 0.5 ton per day HC and NOx.

Improve Station Enforcement Actions. ARB and BAR recommended improving the enforcement of the Smog Check program by restoring staff positions, establishing a specialized prosecution unit within the Attorney General's office, and retaining an Administrative Law Judge dedicated solely to Smog Check. SB 1542 (Figueroa, Chapter 572, Statutes of 2004) requires the Department of Consumer Affairs to appoint, by January 1, 2005, a BAR Administrative and Enforcement Monitor to evaluate BAR by December 31, 2006. This Monitor

is charged with analyzing BAR's practices and procedures rather than directly improving station enforcement. Even though the Legislature did not act on our recommendation, once appointed, the new Monitor may consider our recommendation when reporting back to the Legislature.

Also, in 2004, the Legislature restored funds to BAR's vehicle retirement program, which had been unfunded since 2002. The vehicle retirement program is available to motorists who want to voluntarily retire their vehicles rather than repair them. Eligible consumers can receive \$1000 in exchange for their vehicle. For the 2004/2005 fiscal year, \$4.5 million was made available for vehicle retirement and for the 2005/2006 fiscal year, the budget was increased to \$16.3 million.

In January 2005, the IMRC completed its review of the ARB/BAR report and made its own recommendations for improvements. The IMRC concurred with five out of the eight ARB/BAR Report recommendations and provided additional comments on two other recommendations. The IMRC did not comment on the ARB/BAR recommendation for more stringent cutpoints for after-repair tests. In a January 19, 2005 letter to IMRC, BAR suggested that the impact of recent legislation, and the technical feasibility, cost-effectiveness of the emission benefits, and socio-economic impacts, be fully understood before implementing annual inspections of older vehicles, annual inspections of high mileage vehicles, and including a smoke test as part of the Smog Check inspection.

## **Corrections**

In the review process, ARB and BAR discovered some errors in the Report's cost effectiveness assumptions. The Report and technical support document have been modified to correct these errors, as discussed below.

The cost effectiveness calculations for replacing the 30-year rolling exemption with a pre-1976 model year exemption, for annual testing of vehicles over 15 years old, and for annual testing of taxicabs have been corrected to include the certification fee. The additional \$8.25 cost per vehicle diminishes cost effectiveness slightly. The cost effectiveness figure for replacing the 30-year rolling exemption with a pre-1976 model year exemption increases from \$7,300 per ton to \$7,900 per ton. The cost effectiveness for annual testing of vehicles over 15 years old increases from \$8,500 per ton to just under \$10,000 per ton.

The cost effectiveness for annual testing of taxicabs has also been corrected to be consistent with the emission reductions presented in the Report. The emission reductions in the Report are based on a comparison of before and after repair emission rates for taxicabs. The cost effectiveness that was presented in the draft report, however, used smaller emission reductions that were based on a comparison of before repair and taxicab fleet average emission rates. The net impact of including the certification fee and basing the calculation on larger emission reductions is to improve the cost effectiveness for annual testing of taxicabs, from \$10,000 per ton to \$6,900 per ton.

# 1 Executive Summary

California's enhanced vehicle emissions inspection and maintenance (I/M or Smog Check) program is achieving emission reductions needed to meet health-based air quality standards. This report quantifies the effectiveness of the enhanced Smog Check program as of the end of 2002 and discusses pending enhancements that are designed to further improve program benefits. It also presents recommendations for statutory changes designed to provide additional emission reductions and to make the program friendlier to consumers.

## 1.1 Current and Future Program Effectiveness

This report focuses on the current effectiveness of the enhanced Smog Check program. This program is in place in the urbanized parts of California with the most challenging air quality problems – the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, Ventura County, and, starting in 2003, the San Francisco Bay Area. The enhanced program is just one part of California's overall Smog Check program. Basic Smog Check testing is required biennially in other populated parts of the State, and a basic Smog Check is required upon change of vehicle ownership in rural parts of California. In 2002, about 65 percent of the California fleet was subject to the enhanced program, 32 percent to the basic program, and the remaining three percent to change of ownership testing. To put the assessment of the emission reductions being achieved from the enhanced program in a broader context, Table 1.1 presents the overall statewide emission reductions from the Smog Check program for 2002 based on the EMFAC2002 emissions model. These include the benefits for the entire State – from enhanced, basic, and change of ownership areas. For comparison, the overall emissions from gasoline powered vehicles in 2002 are about 830 tons per day (tpd) hydrocarbons (HC), 8,570 tpd carbon monoxide (CO), and 850 tpd nitrogen oxides (NO<sub>x</sub>). The enhanced program emission benefits presented later in the report are a subset of the total program benefits shown in Table 1.1.

**Table 1.1: Total Statewide I/M Emission Benefits for Calendar Year 2002  
(Enhanced + Basic + Change of Ownership Areas)  
Based on the EMFAC2002 Model**

<b>HC (tpd)</b>	<b>CO (tpd)</b>	<b>NO<sub>x</sub> (tpd)</b>
211	1,360	158

### Evaluation of 2002 Program Benefits

Two approaches were used to evaluate the emission reductions in 2002 from California's enhanced I/M program relative to basic I/M: (1) an analysis of emissions tests from roadside pull-over programs conducted by the Department of Consumer Affairs' Bureau of Automotive Repair (DCA/BAR); and (2) an analysis of the results from the Air Resources Board's (ARB's) EMFAC2002 motor vehicle emissions model. Table 1.2 presents the estimated percent reduction in fleet exhaust emissions resulting from the enhanced Smog Check program in 2002, based on both analytical approaches. Overall, the fleet exhaust emissions were reduced by about

13-15 percent for HC, 14-15 percent for CO, and 9-12 percent for NOx when compared to the basic program emission rates. There is relatively good agreement between the two different approaches used to estimate the enhanced I/M benefits relative to the basic I/M program.

**Table 1.2: Exhaust Emission Benefits of Enhanced I/M Relative to Basic I/M  
in Calendar Year 2002  
(Based on Average Fleet Emission Rates)**

<b>Analysis Type</b>	<b>HC Emissions (% Reduction)</b>	<b>CO Emissions (% Reduction)</b>	<b>NOx Emissions (% Reduction)</b>
Roadside Data Analysis	15%	14%	9%
EMFAC2002 Analysis	13%	15%	12%

The EMFAC2002 model was also used to estimate the additional “tons per day” emission reductions achieved from enhanced I/M in 2002 compared to the basic program, as shown in Table 1.3. To put the enhanced I/M emission reductions in context, Table 1.3 presents the overall I/M emission reductions for enhanced areas in 2002, separated out into the benefits that would be realized if only the basic program were in place and the additional benefits from the enhanced program. As the table shows, the addition of the enhanced program requirements has more than doubled the Smog Check benefits for these areas. The 106 tpd HC, 672 tpd CO, and 76 tpd NOx of emission reductions from the enhanced program beyond the basic requirements are equivalent to removing two million vehicles from California’s roads, making enhanced Smog Check one of the single largest emission reduction programs in California. (Note that the total benefits shown in Table 1.3 do not match those in Table 1.1 because Table 1.3 presents the reductions only for the 65 percent of the State subject to enhanced I/M in 2002 while Table 1.1 presents the reductions for the entire State.)

**Table 1.3: Total I/M Emission Benefits for Enhanced Areas in Calendar Year 2002  
Based on the EMFAC2002 Model**

<b>Enhanced Area Benefits</b>	<b>HC (tpd)</b>	<b>CO (tpd)</b>	<b>NOx (tpd)</b>
Benefits from Basic I/M Requirements in Enhanced Areas	49	448	53
Benefits from Enhanced I/M Requirements*	106	672	76
<b>Total Emission Benefits in Enhanced Areas</b>	<b>155</b>	<b>1,120</b>	<b>129</b>

\*Note: DCA/BAR is implementing some of the enhanced program improvements statewide, instead of in enhanced areas only. These include inspections of gas caps for evaporative emission leaks and liquid fuel leak testing. For the purposes of this evaluation, the emission benefits of these improvements in enhanced areas are considered part of the enhanced program.

The overall cost effectiveness of the I/M program for enhanced areas is estimated to be about \$5,300 per ton of HC and NOx reduced. This cost effectiveness compares favorably to the typical cost effectiveness values for recently adopted ozone control measures of about \$10,000 per ton.

## Evaluation of Future Program Benefits

Since 2001, DCA/BAR has implemented several program improvements that will provide additional emission reductions beyond those being achieved in 2002. These include:

- Adding about six million cars to the enhanced program, including the Bay Area (which increases the percent of the fleet subject to the enhanced program from 65 percent to 87 percent);
- Increasing the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet;
- Lowering the NO<sub>x</sub> inspection standards, or cutpoints, to the levels specified in the State Implementation Plan (SIP); and
- Starting acceleration simulation mode (ASM) dynamometer testing of heavy-duty gasoline powered trucks up to 9,999 pounds gross vehicle weight rating.

In addition to these improvements, DCA/BAR anticipates adding a pressure test of the vehicle's evaporative emissions control system to the program in 2004.

The EMFAC2002 model was used to estimate the future emission benefits projected with all of the improvements mentioned above. The enhanced Smog Check program emission benefits for 2005 and 2010 are shown in Table 1.4. As a result of the aforementioned changes, the projected 2005 and 2010 emission benefits of the enhanced program will be substantially larger than the 2002 enhanced Smog Check emission benefits of 106 tpd HC and 76 tpd NO<sub>x</sub>. The smaller benefit in 2010 compared to 2005 reflects the fact that the overall 2010 fleet is cleaner due to the presence of more newer, ultra-low emitting vehicles and there are fewer excess emissions to be reduced. For comparison, the overall statewide emissions from gasoline powered vehicles are projected to be about 670 tpd HC and 650 tpd NO<sub>x</sub> in 2005 and about 480 tpd HC and 450 tpd NO<sub>x</sub> in 2010.

**Table 1.4: Projected Emission Benefits of Enhanced I/M in Future Years with Program Improvements (relative to Basic program)**

<b>Year</b>	<b>HC (tpd)</b>	<b>NO<sub>x</sub> (tpd)</b>
2005	179 (51)*	158 (44)*
2010	146 (44)*	142 (46)*

\* Numbers in parentheses refer to the emission benefits resulting from the recently implemented program improvements (adding more vehicles to the enhanced program, increasing the fraction of vehicles directed to Test-Only stations, lowering NO<sub>x</sub> cutpoints, and ASM testing of heavy-duty gasoline trucks) and the projected benefits from adding a pressure test of the vehicle's evaporative system. These are a subset of the total enhanced emission benefits shown in the table.

The projected emission benefits shown in Table 1.4 are being incorporated into revised SIPs for the parts of California that continue to violate the federal air quality standards. The revised SIPs will reaffirm the State's Smog Check commitment – reflecting the current estimate of the emission reductions being achieved by the program and committing to achieve additional reductions from the improvements that DCA/BAR is continuing to implement.

## **1.2 Potential Program Improvements**

Enhanced Smog Check is one of the most important emission reduction programs in California, alone providing 106 tpd HC and 76 tpd NOx reductions in 2002. With over 500 tpd of additional combined HC and NOx emission reductions needed in the South Coast by 2010 to meet the federal one-hour ozone standard, it is critical that California continue to achieve all the emission reductions feasible from the Smog Check program. Within this context, DCA/BAR and ARB have evaluated the need for a comprehensive redesign of the program as directed in statute and have also evaluated improvements within the framework of the current program design.

Based on this program evaluation, DCA/BAR and ARB have concluded that the current program is working by delivering cost-effective emission reductions. At this time, it would not be appropriate to propose a comprehensive new program to replace the existing Smog Check program. There are promising technologies such as on-board diagnostics (OBD II) and remote sensing that may offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience. Both technologies are the subject of ongoing studies designed to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, DCA/BAR and ARB will report and recommend further program design changes, if appropriate.

Based on the program evaluation, the following potential improvements to the current program have been identified.

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions through other means. DCA/BAR has existing authority to except these vehicles from the biennial inspection, but a change in State law would be required to authorize DCA/BAR to collect a fee from any excepted vehicles and to use those fees toward programs that would offset the foregone emission reductions.
- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles. This would require a change in State law.
- Inspecting older vehicles annually. This would require a change in State law.
- Inspecting high mileage vehicles annually. This would require a change in State law.
- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired.

- Improving the enforcement of Smog Check program requirements by:
  - Authorizing funding to restore enforcement positions at DCA/BAR;
  - Establishing a specialized prosecution unit within the Attorney General’s office to focus on Smog Check program cases (which would likely require direction from the Legislature); and
  - Granting statutory authority for DCA/BAR to retain Administrative Law Judges dedicated solely to conducting hearings associated with Smog Check disciplinary actions (which would require a change in State law).
  
- Adding a smoke test to the Smog Check inspection to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles. This would require a change in State law.
  
- Excepting newer cars (two years old or less that are still under full warranty) from the requirement for a Smog Check upon change of ownership. This would require a change in State law.

These potential improvements are discussed in detail in Section 4 of this report.

## **2 Introduction and Background**

The federal Clean Air Act requires states with areas that do not meet health-based federal air quality standards to develop SIPs describing how and when the state will attain the standards. The Smog Check program to reduce emissions from motor vehicles is an integral part of California's SIP. The legislation governing the I/M program in California requires DCA/BAR and ARB to periodically report on the effectiveness of the program and recommend possible improvements. This report is intended to meet these requirements.

### **2.1 History of the I/M Program in California**

In the 1977 amendments to the Clean Air Act, Congress required areas that did not attain the ambient air quality standards by 1982 to implement I/M programs to reduce emissions from in-use cars and light-duty trucks. In 1982, the Legislature approved a Smog Check program for the portions of California with the most serious air quality problems, opting for a program based on inspections at privately-owned inspection stations (a "decentralized" program) that would meet the U.S. Environmental Protection Agency (U.S. EPA) targets for HC and CO reductions. DCA/BAR was charged with implementing the Smog Check program. Implementation of the Smog Check program began in 1984.

In the 1982 legislation, the Legislature also created the California I/M Review Committee and charged the Committee with analyzing the effect of the program on vehicle emissions and air quality. The California I/M Review Committee is an advisory group, whose functions pertain primarily to gathering, analyzing, and evaluating data and making recommendations to the Legislature.

In the 1990 amendments to the Clean Air Act, Congress required ozone nonattainment areas classified as serious, severe, or extreme to implement an enhanced I/M program in certain urban areas. In California, these nonattainment areas are the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, and Ventura County. U.S. EPA's regulations implementing the Clean Air Act specify a "model" enhanced program based on centralized stations that do not repair vehicles (also known as centralized "Test-Only" stations) and emissions testing on a transient cycle using a treadmill-like device called a dynamometer. The dynamometer allows emissions of NO<sub>x</sub> as well as HC and CO to be measured. Because of the extensive network of existing Smog Check stations in California, the Legislature did not initially approve this type of enhanced program. A compromise was reached with U.S. EPA, and in 1994, the Legislature approved a redesign of the program. Implementation of this next generation of California's I/M program, known as the enhanced Smog Check program, started on June 8, 1998.

### **2.2 Recent I/M Program Developments in California**

Since the initial implementation of Smog Check, a number of developments have had significant impacts on the enhanced program. These include several legislative changes enacted in 1997 to make the Smog Check program more consumer-friendly. This legislation exempted pre-1974 vehicles from all program requirements, excepted new vehicles from inspection for their first

four years, allowed waivers for the vehicles that are most costly to repair, repealed annual inspections for certain vehicles, and reduced the repair cost limit for low income motorists.

### July 2000 Program Evaluation

In July 2000, ARB released an initial evaluation of the enhanced Smog Check program effectiveness. The report included an evaluation of the program in Summer 1999 (at which time new program elements were still being phased in) and an estimate of the emission reductions being achieved in Summer 2000 when additional program elements had been implemented. Major findings of this evaluation included the following.

- Based on the Summer 1999 evaluation period, the enhanced program was achieving about 36 percent of the combined HC and NO<sub>x</sub> emission reductions specified in the SIP. Three reasons were identified for the shortfall in program benefits:
  - More rigorous program elements were being phased in over a longer timeframe;
  - The SIP target assumed additional communities and vehicles would be subject to enhanced I/M; and
  - Legislative changes had reduced the effectiveness of the enhanced program.
- Program effectiveness at the time of the report (July 2000) had increased to 60 percent of the HC plus NO<sub>x</sub> reductions specified in the SIP, due to the implementation of more stringent NO<sub>x</sub> inspection standards (also known as cutpoints) starting in October 1999.
- The report also identified a set of options for improving the enhanced program.

In an August 17, 2000 letter to U.S. EPA, ARB and DCA/BAR committed to implement several near-term improvements aimed at addressing the shortfall between the SIP target and the actual Smog Check benefits identified in the July 2000 ARB report. Almost all of these program improvements are now in place. The current status of each improvement is summarized below.

- **More Stringent NO<sub>x</sub> Standards:** NO<sub>x</sub> cutpoints were tightened on December 6, 2000, to the maximum extent allowable by the regulations in place at the time. New regulations to tighten NO<sub>x</sub> cutpoints further to the levels specified in the SIP were adopted in June 2002. These tighter cutpoints were introduced in three phases on October 30, 2002, December 4, 2002, and January 8, 2003.
- **Loaded Mode Testing for Heavy-Duty Gasoline-Powered Vehicles:** A regulatory package requiring ASM dynamometer testing of vehicles up to 9,999 pounds gross vehicle weight rating (GVWR)<sup>1</sup> took effect on February 20, 2003, and implementation of this improvement began on May 1, 2003.

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<sup>1</sup> ARB's July 2000 evaluation report anticipated the addition of ASM testing of all HDVs up to 14,000 pounds GVWR. However, some vehicles greater than 9,999 pounds GVWR cannot be tested on the current test equipment due to their weight and/or width. DCA/BAR plans to re-examine this issue in the future to determine if any of the heavier vehicles can be ASM tested instead of the current two speed idle (TSI) testing that they receive.

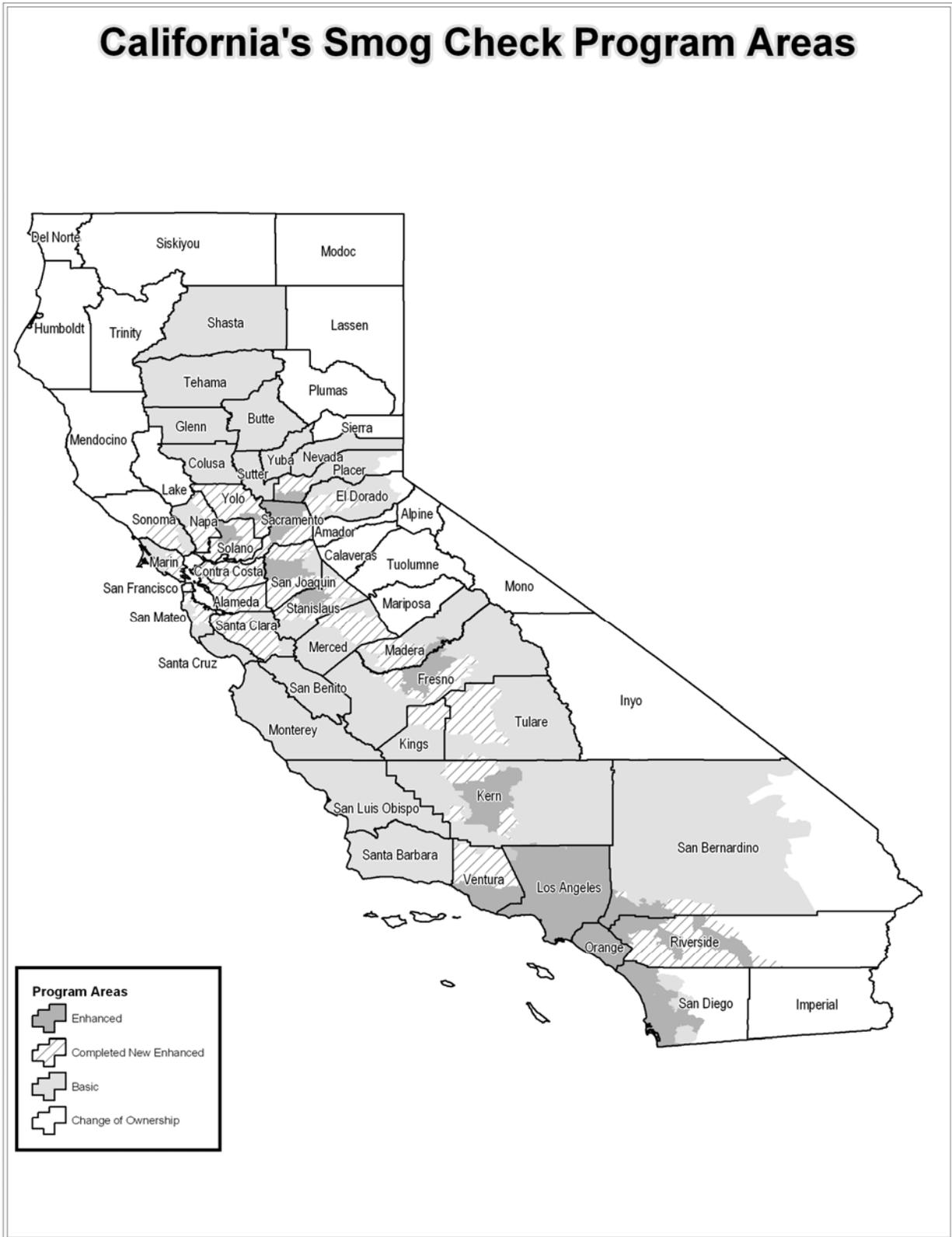
- **Improved Evaporative Emissions Testing:** Liquid fuel leak checks were implemented in September 2001. A pressure test of the vehicle evaporative emissions control system is targeted for implementation in 2004.
- **Direct More Vehicles to Test-Only or Other High-Performance Stations:** At the time of the July 2000 evaluation, 15 percent of the registered vehicles subject to the biennial Smog Check program were being directed to Test-Only stations in the enhanced areas. As of August 2002, DCA/BAR increased the percentage of vehicles directed to Test-Only for biennial inspections to 36 percent of the enhanced area fleet.
- **Remote Sensing:** DCA/BAR and ARB are conducting a remote sensing device (RSD) pilot study to: (1) collect remote sensing readings from approximately one million vehicles; (2) direct up to 5,000 vehicles to Smog Check stations for inspection and repair; and (3) evaluate the most appropriate role of RSD in the enhanced Smog Check program. The results of the pilot study will be used to design an on-going RSD program. In addition, a separate contract has been awarded to a vendor for purchase of 15 RSD units, which DCA/BAR will use to collect additional remote sensing data.
- **Expand Enhanced Areas:** At the time of the July 2000 evaluation, only those vehicles located in urbanized areas of 50,000 or more people were subject to Smog Check in the enhanced I/M areas. Since that time, the enhanced Smog Check program requirements have been extended to additional parts of California as a result of new areas reaching the 50,000 population threshold, local air districts opting in new areas, and Legislative action to include the San Francisco Bay Area. These changes add to the enhanced Smog Check program about six million cars which had previously been subject to the basic I/M requirements, resulting in additional emission reductions. Table 2.1 summarizes the new areas added to the program. Figure 2.1 illustrates the different Smog Check program areas in California. After adding these new areas, about 87 percent of the California fleet will be located in enhanced program areas, 10 percent in basic program areas, and three percent in change of ownership areas.

**Table 2.1: Summary of New Areas Added to Enhanced I/M Program**

Area (Air District or Air Basin)	Approximate Number of Vehicles Added (estimated May 2002)			Date of Request by Air District	Date of Implementation
	Full Enhanced*	Partial Enhanced*	Total		
San Joaquin Unified APCD	322,000	519,000	841,000	04/19/01	05/01/02
Ventura County APCD	0	35,000	35,000	06/12/01	07/01/02
Sacramento Metro AQMD	0	33,000	33,000	09/27/01	07/01/02
South Coast AQMD	60,000	243,000	303,000	02/01/02	11/01/02
Placer County APCD	0	58,000	58,000	04/11/02	04/01/03
Yolo-Solano AQMD	38,000	33,000	71,000	12/12/01	04/01/03
San Francisco Bay Area	4,800,000	0	4,800,000	09/27/02	10/01/03
El Dorado County APCD	19,000	73,000	92,000	04/16/02	12/01/03

\*Full enhanced refers to vehicles subject to all elements of the enhanced program, including potentially being directed to Test-Only stations. Vehicles in partial enhanced areas are not subject to the Test-Only provisions.

Figure 2.1



## Additional Recent Program Improvements

DCA/BAR has also implemented several other recent improvements to the Smog Check program, which provide additional motorist convenience and/or result in additional emission reductions, as discussed below.

**Gold Shield Program:** On July 1, 2003, DCA/BAR reduced the number of station types by implementing a new Gold Shield Program. The Gold Shield stations meet higher standards and perform a wider range of services. This change should make it easier for motorists to get through the Smog Check process.

**Special Outreach for Low-Income Motorists:** DCA/BAR maintains an ongoing effort to share information with low income and minority consumers concerning programs that may assist them. In addition to a statewide media advertising campaign, DCA/BAR technicians travel to urban communities and participate in local events using a mobile Referee station that became available on September 21, 2002. This vehicle includes a portable dynamometer and a waiting room for consumers, and provides consumers with computer-generated vehicle inspection reports on site. In addition, technicians answer automotive questions, demonstrate how the dynamometer works, and offer information about the Consumer Assistance Program (CAP).

**Tijuana Project:** DCA/BAR, the State of California, and Mexico have agreed to develop a new vehicle emissions inspection program in the City of Tijuana. Such a program would reduce vehicle emissions and benefit communities on both sides of the border. DCA/BAR has provided consultation, equipment, and training for a pilot Smog Check program. The City of Tijuana inaugurated its first Smog Check inspection station on July 10, 2003.

**Tamper Detection and Certification Program (TDC):** DCA/BAR and ARB have been training peace officers to identify obvious tampering of the vehicle emission system as an additional aspect of routine traffic stops. If cited, these vehicles must be fully repaired. The TDC pilot program has been ongoing since April 1999. As of February 2003, approximately 5,000 TDC-cited vehicles were tested at State referee sites. Emission reductions from the failing vehicles contribute additional (off-cycle) benefits to the current Smog Check program.

**Continuous Testing Pilot Program:** DCA/BAR and ARB have been conducting a Continuous Testing Pilot Program to investigate the feasibility of remote monitoring of OBD II status of high mileage fleet vehicles. Under this program, an aftermarket telematics device that sends information on vehicle performance over a wireless network has been installed on a number of high mileage OBD II-compliant vehicles (i.e., taxicabs as well as a few privately-owned vehicles). The device is used to transmit the full OBD II data stream from each vehicle to a website accessible to the agencies. ARB is performing tailpipe emissions tests on some of the vehicles involved in this program, particularly any that report an OBD II problem.

**Quality Assurance (QA) Program:** DCA/BAR performs twice yearly QA inspections at all enhanced area Smog Check stations to ensure proper testing and/or repairing of vehicles as well as compliance with all applicable laws and regulations. In March 2003, DCA/BAR enhanced its QA Program with an additional element aimed at improving station and technician repair effectiveness. DCA/BAR implemented the Clean Car pilot program to specifically address the diagnostic and repair practices of licensed Test-and-Repair Smog Check stations. Clean Car staff visit selected Smog Check stations and evaluate each station/technicians diagnostic and repair abilities. The staff offers constructive suggestions on ways to more effectively diagnose and repair vehicles in order to attain increased emission reductions. Consumer protection is enhanced by placing emphasis on complete and effective diagnosis and proper invoicing of repairs performed.

### **2.3 Reporting Requirements**

The legislation that established Smog Check also requires DCA/BAR and ARB to periodically assess the effectiveness of the enhanced program to determine whether changes might be warranted. Under Health and Safety Code (H&S) Section 44003(a)(2), the agencies are specifically required to jointly submit a report to the Legislature, based on these specific assessments, which recommends:

*...any modifications to the enhanced program to improve its operations and lessen its impact on consumers while still achieving the necessary emission reductions to attain air quality standards.*

Section 44003(a)(2) also stipulates that the report is to include a review of any program proposed pursuant to Section 15 of Chapter 803 of the Statutes of 1997. Section 15 contains the following provision:

*...the State Air Resources Board and the Bureau of Automotive Repair shall design a new proposed program to replace the existing vehicle inspection and maintenance program and submit to the Legislature a report on the new program.*

Section 15 also directs the California I/M Review Committee to review the program proposed by ARB and DCA/BAR and issue its own report to the Legislature.

In addition, Section 44021(e) also requires ARB, in cooperation with DCA/BAR, to submit triennial reports to the California I/M Review Committee that include:

*...an assessment of the impact on emissions of continuing the exemption from inspection of motor vehicles newer than five years old; a comparison of the actual mass emission reductions being achieved by the enhanced program to those required by the State Implementation Plan; and recommendations to improve the effectiveness and cost-effectiveness of the program, including specific recommendations addressing any discrepancy between emissions achieved and those in the State Implementation Plan.*

This draft report is being submitted to the California I/M Review Committee pursuant to Section 44021(e). ARB and DCA/BAR will work cooperatively with the California I/M Review Committee to obtain comments on this report from the committee and the public. At the conclusion of this public process, ARB and DCA/BAR intend to submit a final report to the Legislature as required by Section 44003(a)(2).

### 3 Evaluation of the Enhanced I/M Program

In this section, an evaluation of the emission reductions currently being achieved from the enhanced Smog Check program is presented. In addition, the relationship between the Smog Check program and the emission benefits specified in the SIP is presented.

#### 3.1 Emission Reductions from the Current Program

This report focuses on the current effectiveness of the enhanced Smog Check program. This program is in place in the urbanized parts of California with the most challenging air quality problems – the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, Ventura County, and, starting in 2003, the San Francisco Bay Area. The enhanced program is just one part of California’s overall Smog Check program. Basic Smog Check testing is required biennially in other populated parts of the State, and a basic Smog Check is required upon change of vehicle ownership in rural parts of California. (Figure 2.1 illustrates the parts of California subject to the different Smog Check program elements.) In 2002, about 65 percent of the California fleet was subject to the enhanced program, 32 percent to the basic program, and the remaining three percent to change of ownership testing. To put the assessment of the emission reductions being achieved from the enhanced program in a broader context, Table 3.1 presents the overall statewide emission reductions from the Smog Check program for 2002 based on the EMFAC2002 emissions model. These include the benefits for the entire State – from enhanced, basic, and change of ownership areas. For comparison, the overall emissions from gasoline powered vehicles in 2002 are about 830 tpd HC, 8,570 tpd CO, and 850 tpd NOx.

**Table 3.1: Total Statewide I/M Emission Benefits for Calendar Year 2002  
(Enhanced + Basic + Change of Ownership Areas)  
Based on the EMFAC2002 Model**

<b>HC (tpd)</b>	<b>CO (tpd)</b>	<b>NOx (tpd)</b>
211	1,360	158

The rest of this section presents an evaluation of the enhanced Smog Check program. The enhanced Smog Check emission benefits discussed below are a subset of the total statewide Smog Check benefits shown in Table 3.1.

Two approaches were used to evaluate the emission reductions from California’s enhanced I/M program: (1) an analysis of emissions tests from roadside pull-over programs; and (2) an analysis of the results from ARB’s EMFAC2002 motor vehicle emissions model. Each of these approaches has its strengths and weaknesses. A roadside pull-over program provides very good data on the fleet at the time of inspection. However, unless the roadside tests are conducted during a time period when some vehicles are subject to the program and some are not, it is difficult to establish a non-I/M baseline (or an “Old-I/M” baseline in an old program versus new program comparison) with which to compare the results. In addition, forecasting emissions to the future is not possible solely with roadside data. These limitations in the use of roadside data

are overcome with emissions models. Emissions models have the advantage of being able to estimate fleet emissions for different I/M program parameters, and they are capable of forecasting emissions into the future taking into consideration changes to the program that are implemented over time. However, certain inputs to emissions models are sometimes based on limited data, and therefore, the results are subject to some uncertainty.

### Roadside Data Evaluation

Random roadside tests are conducted by DCA/BAR with the assistance of the California Highway Patrol (CHP). Although the inspection is not mandatory, the majority of motorists pulled over participate in the program. One of the purposes of the random roadside inspections is to collect exhaust emissions data to evaluate the emissions performance of the in-use motor vehicle fleet and to compare those results to the data collected in the Smog Check program.

The data used in this evaluation were collected over two periods – one representing the emissions from vehicles that had not been subject to the enhanced Smog Check program and the second representing the emissions from vehicles that had been tested under the enhanced Smog Check program. Roadside data collected between November 1998 and October 1999, were originally used in ARB's July 2000 evaluation of the Smog Check program effectiveness. (This will be referred to as the 1999 roadside data.) These roadside tests included vehicles that had never been subject to the ASM dynamometer testing required under the enhanced Smog Check program as well as vehicles that had been through ASM testing. The data collected from the subset of vehicles that had never gone through ASM testing are reused in the current analysis to represent the average fleet emissions in the “before enhanced I/M” case.

Subsequent to the 1999 roadside program, DCA/BAR conducted additional random roadside ASM inspections in enhanced I/M program areas in California between January 2000 and October 2002. Nearly all the vehicles in this data set have been through at least one enhanced I/M test cycle, so it was not possible to estimate the “before enhanced I/M” emissions using these newer data. The average fleet emissions under the “current enhanced I/M” program were estimated using data collected from October 1, 2001, through October 31, 2002. (This will be referred to as the 2002 roadside data.) The percent reduction in fleet average emissions resulting from the enhanced Smog Check program is estimated by comparing the “current enhanced I/M” data to the previously available “before enhanced I/M” data.

The emissions data collected in the roadside test are measured as a concentration – in parts per million or percent by volume depending on the pollutant. For this evaluation, the ASM concentration data collected in the 1999 and 2002 roadside programs were converted to predicted Federal Test Procedure (FTP) emission rates in units of grams per mile (g/mi) using correlation equations that were newly developed for this analysis.<sup>2</sup> (The FTP is the test used for emissions testing and certification of all new passenger cars and light-duty trucks.) This conversion from a

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<sup>2</sup> The general approach for developing the correlations closely followed the methodology used in the July 2000 Smog Check evaluation. However, a new data set was used that included additional ASM-FTP test results, particularly for late-model vehicles (i.e., 1996 and newer model year vehicles). In addition, separate conversion equations were developed for pre-1990 and 1990 and newer model year vehicles.

concentration to a g/mi emission rate allows for comparison to the modeled EMFAC2002 emission estimates.

The ASM-to-FTP correlation equations were applied to the roadside ASM test measurements to develop predicted FTP emission rates for each vehicle in the 1999 and 2002 Roadside databases. Mean emission rates were developed for each model year separately for the “1999 Before ASM” sample and the “2002 After ASM” sample. Results from the EMFAC2002 model were then used to forecast model-year specific FTP-based emissions from the “1999 Before ASM” sample to a 2002 basis to account for anticipated emission control system deterioration between 1999 and 2002. In short, this conversion allowed for a more direct comparison of data collected in 1999 with data collected in 2002. In estimating the fleet average emission rate in enhanced areas, an adjustment was made to account for the fact that a small fraction of vehicles in enhanced areas receive a two-speed idle (TSI) test instead of an ASM test because these vehicles are equipped with full-time four wheel drive or traction control that cannot be disabled. Overall, an analysis of the July 2002 Smog Check Vehicle Information Database (VID) data found that about 3.6 percent of enhanced area vehicles actually received a TSI test.

*Results of Roadside Data Analysis* – The fleet-average FTP-based exhaust emissions results from the roadside data analysis are summarized in Table 3.2.

**Table 3.2: Fleet-Average FTP Exhaust Emission Reductions  
Based on Roadside Data Analysis**

<b>I/M Scenario</b>	<b>HC (g/mi)</b>	<b>CO (g/mi)</b>	<b>NOx (g/mi)</b>
Fleet Emission Rate Before ASM Representing the Basic I/M Program (Based on 1999 roadside data)	0.70	8.5	0.62
Fleet Emission Rate After ASM Representing the Enhanced I/M Program (Based on 2002 roadside data)	0.59	7.3	0.56
<b>Percent Reduction Enhanced vs. Basic I/M</b>	<b>15%</b>	<b>14%</b>	<b>9%</b>

The current analysis shows fleet average exhaust emission reductions of 15 percent for HC, 14 percent for CO, and 9 percent for NOx when the enhanced program is compared to the basic program. It should be noted that DCA/BAR has already implemented several program improvements since the most recent roadside testing was completed as mentioned in Section 2, so the program is anticipated to achieve additional benefits beyond those shown in Table 3.1. In addition, it should be noted that the roadside evaluation only addresses exhaust emissions; it does not evaluate the evaporative emissions element of the program.

#### EMFAC2002 Evaluation

To evaluate the effectiveness of the current enhanced I/M program using an emissions modeling approach, the EMFAC2002 model (version 2.2 released April 23, 2003) was run under two

different I/M scenarios. The first represented the enhanced I/M program in place during 2002. For the second scenario, the enhanced I/M program was replaced with the basic I/M program in place to represent the fleet emissions that would exist if the enhanced program had not been implemented. The difference in emissions between these two scenarios represents the benefits for 2002 of the enhanced I/M program relative to the basic I/M program. These benefits are shown in Table 3.3.

To put the enhanced I/M emission reductions in context, Table 3.3 presents the overall I/M emission reductions for enhanced areas in 2002, separated out into the benefits that would be realized if only the basic program were in place and the additional benefits from the enhanced program. As the table shows, the addition of the enhanced program requirements has more than doubled the Smog Check benefits for these areas. The 106 tpd HC, 672 tpd CO, and 76 tpd NOx of emission reductions from the enhanced program beyond the basic requirements are equivalent to removing two million vehicles from California’s roads, making enhanced Smog Check one of the largest emission reduction programs in California. (Note that the total benefits shown in Table 3.3 do not match those in Table 3.1 because Table 3.3 presents the reductions only for the 65 percent of the State subject to enhanced I/M in 2002 while Table 3.1 presents the reductions for the entire State.)

**Table 3.3: Total I/M Emission Benefits for Enhanced Areas in Calendar Year 2002 Based on the EMFAC2002 Model**

<b>Enhanced Area Benefits</b>	<b>HC (tpd)</b>	<b>CO (tpd)</b>	<b>NOx (tpd)</b>
Benefits from Basic I/M Requirements	49	448	53
Benefits from Enhanced I/M Requirements*	106	672	76
<b>Total Emission Benefit in Enhanced Areas</b>	<b>155</b>	<b>1,120</b>	<b>129</b>

\*Note: DCA/BAR is implementing some of the enhanced program improvements statewide, instead of in enhanced areas only. These include inspections of gas caps for evaporative emission leaks and liquid fuel leak testing. For the purposes of this evaluation, the emission benefits of these improvements in enhanced areas are considered part of the enhanced program.

Since 2001, DCA/BAR has implemented several program improvements which will provide additional emission reductions beyond those shown in Table 3.3.

- Between May 2002 and December 2003, about six million vehicles were added to the enhanced program (which increases the percent of the fleet subject to the enhanced program from 65 percent to 87 percent).
- DCA/BAR increased the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet, starting with the August 2002 mailing of December 2002 renewals.
- In January 2003, DCA/BAR lowered the NOx cutpoints to the levels specified in the SIP.

- In May 2003, ASM testing of heavy-duty trucks up to 9,999 pounds gross vehicle weight rating started.
- In addition to these improvements, DCA/BAR anticipates adding a pressure test of the vehicle evaporative emissions control system to the program starting in 2004.

These improvements will result in additional emission benefits beyond those being achieved in 2002. The EMFAC2002 model was used to estimate the future enhanced Smog Check emission benefits projected with these improvements in place. The enhanced Smog Check program emission benefits for 2005 and 2010 are shown in Table 3.4. As a result of the aforementioned changes, the projected 2005 and 2010 emission benefits of the enhanced program will be substantially larger than the 2002 enhanced Smog Check emission benefits of 106 tpd HC and 76 tpd NOx. The smaller benefit in 2010 compared to 2005 reflects the fact that the overall 2010 fleet is cleaner due to the presence of more newer, ultra-low emitting vehicles and there are fewer excess emissions to be reduced. For comparison, the overall statewide emissions from gasoline powered vehicles are projected to be about 670 tpd HC and 650 tpd NOx in 2005 and about 480 tpd HC and 450 tpd NOx in 2010.

**Table 3.4: Projected Emission Benefits of Enhanced I/M in Future Years with Program Improvements (relative to Basic program)**

Year	HC - tpd (portion of benefits from recent improvements)	NOx - tpd (portion of benefits from recent improvements)
2005	179 (51)*	158 (44)*
2010	146 (44)*	142 (46)*

\* Numbers in parentheses refer to the emission benefits resulting from the recently implemented program improvements (adding more vehicles to the enhanced program, increasing the fraction of vehicles directed to Test-Only stations, lowering NOx cutpoints, and ASM testing of heavy-duty gasoline trucks) and the projected benefits from adding a pressure test of the vehicle's evaporative system. These are a subset of the total enhanced emission benefits shown in the table.

#### Summary of Roadside Versus EMFAC2002 Results

The modeled results from EMFAC2002 can also be presented as an average fleet emission rate to allow for a more direct comparison with the roadside analysis as shown in Table 3.5, which summarizes the FTP-based fleet-average exhaust emissions results from both approaches. There is relatively good agreement between the two different approaches used to estimate percent reductions in exhaust emissions achieved from the enhanced I/M program relative to the basic I/M program. Overall, the fleet exhaust emissions were reduced by 13-15 percent for HC, 14-15 percent for CO and 9-12 percent for NOx when compared to the basic program emission rates. While the fleet-average grams-per-mile exhaust emission rates from these two approaches are somewhat different, this is not unexpected considering that different data sources and methodologies were used in each. The main purpose of the evaluation was to determine the percent by which exhaust emissions were reduced under the enhanced program.

**Table 3.5: Exhaust Emission Benefits of Enhanced I/M in Calendar Year 2002  
Based on the Roadside Data Analysis and the EMFAC2002 Model  
(FTP-Based Emission Rates)**

<b>Analysis</b>	<b>I/M Scenario</b>	<b>HC (g/mi)</b>	<b>CO (g/mi)</b>	<b>NO<sub>x</sub> (g/mi)</b>
Roadside Data Analysis	Fleet Emission Rate Before ASM Representing the Basic I/M Program	0.70	8.5	0.62
	Fleet Emission Rate After ASM Representing the Enhanced I/M Program	0.59	7.3	0.56
	<b>Percent Reduction</b>	<b>15%</b>	<b>14%</b>	<b>9%</b>
EMFAC2002 Analysis	Fleet Emission Rate Under Basic I/M Program	0.83	9.5	0.75
	Fleet Emission Rate Under Enhanced I/M Program	0.72	8.1	0.66
	<b>Percent Reduction</b>	<b>13%</b>	<b>15%</b>	<b>12%</b>

### 3.2 State Implementation Plan Targets

#### Background on the 1994 Ozone SIP

In November 1994, California submitted to U.S. EPA a comprehensive SIP, detailing how six areas of the State – San Diego, the San Joaquin Valley, Ventura, Sacramento, the Southeast Desert, and the South Coast – would attain the one-hour federal ozone standard. The Smog Check program was a critical element of the 1994 SIP along with other local, State, and federal measures for motor vehicles, stationary sources, and area sources.

When the 1994 SIP was developed, ARB made its best estimate of emission benefits expected from the enhanced Smog Check program and from other State control measures. At that time, an enhanced Smog Check program had not been implemented anywhere in the country, so there were limited data upon which to estimate the potential emission benefits.

As the 1994 SIP has been implemented over the last nine years, ARB has adjusted its expectations based on actual evolution of its control program. Most of the measures specified in the 1994 SIP have been adopted. Some measures have provided more reductions than specified in the SIP, while others have provided less. ARB has also adopted several measures that were not envisioned when the SIP was developed in 1994. For example, measures which called for the early retirement of motor vehicles did not provide the emission reductions originally envisioned, as funding needed for such programs didn't materialize. On the other hand, the Low Emission Vehicle II program provided much greater emission reductions than anticipated. In addition, measures not originally included in the SIP, such as new emission standards for heavy-duty trucks starting in 2007, will provide significant emission reductions.

In the case of Smog Check, the enhanced program is achieving significant emission reductions needed to meet the air quality standards (106 tpd HC, 76 tpd NO<sub>x</sub>, and 672 tpd CO in Summer

2002). However, the implementation of the program proceeded more slowly than specified in the SIP. Inspection cutpoints were tightened to the levels specified in the SIP incrementally in recognition of the impact of the Smog Check program directly on individual consumers. Some elements of the program have been especially technically challenging to implement, such as more comprehensive evaporative emissions testing. The low pressure evaporative test is not yet in place, but DCA/BAR envisions introducing that program improvement in 2004. While some program elements have taken longer to implement than expected at the time the 1994 SIP was developed, other actions such as the decisions by local air districts to add vehicles to the enhanced program are providing additional emission benefits.

In addition to adjusting the expectations regarding the implementation of its control program, ARB has updated its technical tools – greatly improving the accuracy of its mobile source emissions inventory since the 1994 SIP was developed. More extensive real-world testing of vehicles and greater numbers of older vehicles on the road result in higher emissions than estimated in prior SIPs. The emissions inventory used in the 1994 SIP no longer represents our best understanding of real world emissions. The current Smog Check emission reduction estimates cannot be directly compared to the 1994 SIP targets because the updated estimate of motor vehicle emissions is so much higher. To be meaningful in the context of this updated understanding of the emissions that contribute to California’s air quality problems, the expectations for the State’s emissions control program must be updated to reflect the new inventory.

#### Updating the SIP and the Smog Check Commitment

ARB and the local air districts are undertaking comprehensive SIP revisions to reflect the updated emissions information and the updated understanding of the benefits of the State’s control program. Recent technical work in the South Coast and San Joaquin Valley show that both regions need further emission reductions to meet the existing federal air quality standards by 2010. In addition, changes in federal policy require that these SIPs be updated to reflect new emissions estimates and controls for motor vehicles in order to preserve California’s ability to secure federal transportation funding. With virtually all of the State’s 1994 SIP measures already adopted and being implemented, ARB must develop new measures to continue progress. The updated SIPs identify a series of new State commitments to achieve the next increment of progress toward the federal one-hour ozone and PM10 standards. The San Joaquin Valley’s updated PM10 SIP was approved by ARB in June 2003, and the South Coast’s updated SIP was approved by ARB in October 2003. Updated ozone SIPs for the San Joaquin Valley, Sacramento, and Ventura are expected in the next year or two.

The revised SIPs reaffirm the State’s Smog Check commitment – reflecting the current estimate of the emission reductions being achieved from the program and committing to achieve additional reductions from the improvements that DCA/BAR is continuing to implement.

- The baseline emission inventories for the new SIPs reflect the 106 tpd HC, 76 tpd NOx, and 672 tpd CO being achieved under the current enhanced Smog Check program in summer 2002. The inventories also project these emission benefits into future years. By reflecting these emission reductions in the baseline emission inventory, these reductions

become an enforceable part of the SIP. Any future changes that would result in a loss of benefits would need to be made up in order to keep the SIP whole.

- The new SIPs also include quantified emission reduction commitments to reflect ongoing and upcoming program improvements that have not yet been incorporated into the emission inventory. These include:
  - Increasing the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet. DCA/BAR implemented this improvement in 2002, but the benefits have not yet been reflected in the baseline emission inventory.
  - Loaded mode testing for heavy-duty gasoline-powered vehicles up to 9,999 pounds gross vehicle weight rating. DCA/BAR began implementing this improvement on May 1, 2003, but the benefits have not yet been reflected in the baseline emission inventory.
  - Improved Evaporative Emissions Testing. A pressure test of the vehicle evaporative emissions control system is targeted for implementation in 2004.

These program improvements will be implemented in all enhanced I/M areas. With these improvements, the overall enhanced Smog Check benefit is estimated to be 179 tpd HC and 158 tpd NOx in 2005 and 146 tpd HC and 142 tpd NOx in 2010.

### Further Reductions Still Needed

While the Smog Check improvements listed above are being incorporated into the updated SIPs, additional emission reductions are needed from all sources to meet California's air quality goals. The 2003 South Coast SIP contains new, near-term State and local commitments designed to achieve over 250 tpd of HC and NOx reductions (including the Smog Check improvements), as well as a long-term commitment to achieve over 300 tpd of additional HC and NOx reductions by 2010. For the San Joaquin Valley to meet the federal one-hour ozone standards, preliminary estimates indicate approximately a 30 percent overall reduction in HC and NOx emissions will be needed. Achieving these reductions by 2010 will pose a significant challenge. Meeting the federal eight-hour ozone, the federal PM2.5 standards, and the State air quality standards will require even greater emission reductions. State, federal, and local air quality control agencies will need to continue pursuing cost-effective and feasible emission reductions from all sources.

Despite the significant emission reductions from motor vehicles that have occurred in recent years, emissions from passenger cars, pickup trucks, and medium-duty vehicles alone will still account for over 20 percent of the HC and NOx emissions in 2010. Most of these motor vehicle emissions come from the older part of the fleet as new cars become cleaner and cleaner. In 2010, it is projected that those cars 13 years and older (pre-1998 model years) will account for about 75 percent of the HC and NOx emissions from the light-duty fleet despite accounting for only about 25 percent of the miles traveled. To meet California's air quality goals, additional emission reductions are needed from the existing fleet – particularly these older vehicles.

Additional Smog Check program improvements beyond those being committed to in the upcoming SIP may prove to be the most cost-effective way to achieve these needed emission reductions. Section 4 of this report identifies potential improvements to the Smog Check program that could provide some of these reductions. Many of these improvements would require changes to State law.

### **3.3 Impact of Five/Six Model Year Exception**

Assembly Bill (AB) 2637, signed by Governor Davis in September 2002, establishes an enhanced I/M program in the San Francisco Bay Area Air Basin. As part of the bill, the current four-year Smog Check exception for new motor vehicles was extended statewide to six years, with the goal of minimizing the burden of the program on vehicles less likely to fail an inspection. The extension of the biennial exception was to take effect on January 1, 2004, unless ARB determined that the change would prohibit the State from meeting its SIP commitments or the requirements of the federal Clean Air Act.

As directed by AB 2637, ARB analyzed the potential emissions impact of extending the current four year Smog Check exception for new motor vehicles to five or six years. Both exhaust and evaporative emissions were considered in the evaluation. The analysis focused on those areas of California with enhanced I/M ASM dynamometer testing already in place or expected by January 2004 and thus includes the San Francisco Bay Area. The primary source of data was approximately 13,000 emission tests collected statewide during random pull-over inspections conducted by DCA/BAR between 2000 and 2002. 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 because an evaporative pressure test will not be implemented in California until 2004. 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 data collected during a DCA/BAR roadside study in Fall 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 that would fail an I/M inspection, fleet emission rates with and without five and/or six year old vehicles excepted from biennial inspections were calculated. The difference in fleet emission rates as a percentage increase was applied to the baseline tons per day emission results calculated by the EMFAC2002 model to determine the statewide loss of emission reductions from excepting five and six year old vehicles from inspections. The analysis methodology is similar to the approach used in ARB's July 2000 evaluation of the Smog Check program. The analysis assumes that the excepted vehicles would still be subject to a change of ownership inspection. A 17 percent annual change of ownership rate was used in the analysis.

The results indicate that extending the new vehicle exception for an additional one or two more years would increase vehicle emissions in enhanced I/M areas as shown in Table 3.6. Excepting both five and six year old vehicles from the biennial inspection requirement would increase emissions by about four tpd of HC plus NOx in 2005. Excepting only five year old vehicles

would increase 2005 calendar year emissions by nearly two tpd in enhanced I/M areas. The emission increases from additional Smog Check exceptions would be lower in 2010 because the overall 2010 fleet is cleaner. However, a five or six year exception from the biennial inspection is still estimated to increase ozone-forming emissions by one to three tpd, respectively.

**Table 3.6: Emissions Impact from Five and Six Model Year Exception**

	Enhanced Area Emissions (tpd)					
	HC			CO	NOx	HC+NOx
	Exhaust	Evap.	Total			
<b>2005 Baseline *</b>	259	242	501	5,013	507	1,008
Increase: 5 year exception	0.10	0.59	0.69	4.95	1.08	<b>1.77</b>
Increase: 6 year exception	0.51	1.19	1.70	13.12	2.01	<b>3.71</b>
<b>2010 Baseline *</b>	167	194	361	3,507	344	705
Increase: 5 year exception	0.07	0.47	0.54	3.44	0.73	<b>1.27</b>
Increase: 6 year exception	0.33	0.95	1.28	9.18	1.36	<b>2.64</b>

\*Baseline – Light-duty vehicles subject to Smog Check

The magnitude of the increases would present a significant barrier towards achievement of California’s air quality commitments. Consequently, at its April 24, 2003 Board meeting, ARB made a finding that the emissions impact would adversely affect California’s plan to meet federal air quality standards and adopted a resolution which concludes that the new vehicle exception not be extended to model years five and six in nonattainment areas at this time.

Staff believes that opportunities may exist for more targeted newer vehicle exceptions to the biennial inspection requirement by 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. For example, it may be possible to except certain groups of vehicles (such as Partial Zero Emission Vehicles) whose emission characteristics and extended warranty period suggests few vehicles would fail any inspection. It may also be possible to except individual vehicles, or groups of vehicles, based on roadside measurements or based on historical records collected by DCA/BAR. Studies are underway to establish the effectiveness of these approaches. In Section 4 of this report, a program change is recommended for excepting a subset of the five and six year old vehicles that have the greatest likelihood of passing their Smog Check inspections (see Section 4.2).

### **3.4 Cost Effectiveness of Current Program**

The final portion of the analysis involved estimating the current cost effectiveness of California’s Smog Check program in enhanced areas. The estimated total Smog Check emission benefits for enhanced areas in 2002 is 155 tpd HC and 129 tpd NOx as shown in Table 3.3. Over a full two-

year Smog Check cycle, this equates to 207,000 tons of HC and NO<sub>x</sub> reduced. The initial test failure rate, and the average ASM inspection cost, and average repair cost used to estimate the cost effectiveness are based on data from the 2002 DCA/BAR Executive Summary report. The cost effectiveness shown in Table 3.7 is calculated by dividing the total enhanced program costs by the combined HC and NO<sub>x</sub> benefits.

**Table 3.7: Cost Effectiveness Estimate for Smog Check Program in Enhanced Areas  
Calendar Year 2002**

Enhanced area initial test failure rate (%)	15.6%
Total average ASM inspection cost - includes \$8.25 cert fee (\$/Test)	\$54
Average enhanced repair cost (\$/Vehicle)	\$143
Average test cost per vehicle (\$)	\$76
Number of vehicles subject to I/M	14,421,542
Total cost per I/M cycle (\$)	\$1,102,037,707
Combined HC and NO <sub>x</sub> benefits (tons/ I/M cycle)	207,273
<b>Cost effectiveness (\$/Ton)</b>	<b>\$5,317</b>

The cost effectiveness of about \$5,300 per ton of HC and NO<sub>x</sub> reduced is favorable; typical cost effectiveness values for recently adopted ozone control measures are \$10,000 per ton.

## 4 Opportunities for Enhanced Smog Check Improvement

### 4.1 Introduction

Pursuant to the reporting requirements discussed in Section 2.3, DCA/BAR and ARB evaluated the existing enhanced Smog Check program to determine whether changes might be warranted to improve its operations and lessen its impact on consumers.

As a result of the evaluation, staff identified eight potential near-term program changes to the enhanced Smog Check program that would achieve additional emission reductions and/or improve program operations. Sections 4.2 through 4.8 present background information and evaluation details for these program elements. These eight elements would require legislative action or budgetary approval as the first step towards implementation. These potential changes are:

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions (Section 4.2);
- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles (Section 4.3);
- Inspecting older vehicles annually (Section 4.4);
- Inspecting high mileage vehicles annually (Section 4.5);
- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired (Section 4.6);
- Improving station performance through better enforcement (Section 4.6);
- Adding a smoke inspection test to the Smog Check program to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles (Section 4.7); and
- Excepting newer vehicles from the change of ownership Smog Check test (Section 4.8).

In addition to these recommendations, staff examined several other potential improvements that could increase emission reductions and/or make the program more convenient for motorists. These include adding motorcycles and diesel-fueled vehicles (passenger, light-duty trucks and medium-duty trucks) to the program, improving compliance with vehicle registration requirements, and restarting the vehicle retirement program. Initial evaluation suggests that these improvements may have merit. However, additional study is needed to evaluate emission reduction benefits, ease of implementation, impact on motorists, and cost effectiveness before recommendations for program changes could be made. These potential program improvements are discussed further in Section 4.9.

Section 4.10 discusses the potential for a future, more comprehensive program redesign based on the incorporation of OBD II and remote sensing. These technologies offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience of Smog Check. Both are the subject of ongoing studies to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, further program changes may be proposed.

### **4.1.1 Consumer/Industry Impact**

This report makes a series of recommendations resulting from science-based estimates of emission reductions that would result from certain changes within the Smog Check program. Before adoption, each of the recommendations should be evaluated for their impact on private and commercial vehicle owners as well as the automotive test and repair industry.

Implementation of these recommendations may impose additional requirements on some vehicle owners and reduce requirements on others. In those cases where less frequent testing is required, vehicle owner satisfaction is anticipated to result due to the decreased cost of testing. Based on the report's findings, this can be achieved with little or no detrimental effect to the environment. In those cases where the requirements would be greater, the benefit may not readily be apparent to the vehicle owner. However, vehicles that operate efficiently pollute less and realize better fuel economy.

Nevertheless, a thorough analysis of the social and economic impacts of the recommendations should be undertaken in evaluating whether, and in what timeframe, they should be implemented. This is because they will bear a cost to some segments of the economy, will reduce costs to other segments and will increase business opportunities for a third segment, the Smog Check station industry.

This is best addressed through the California I/M Review Committee's public review process to evaluate those factors.

### **4.2 Clean Screen for Five and Six Year Old Vehicles**

Background: Currently, the newest four model year vehicles are excepted from their biennial Smog Check inspection. AB 2637 extended the exception for newer vehicles by two more model years, unless ARB determined the extension would adversely affect California's ability to meet its SIP commitments and Federal Clean Air Act requirements. At its Board meetings in April and May 2003, ARB determined that it would be necessary to exclude all enhanced areas from the five/six year exception as well as select basic areas (where federal air quality standards have not yet been attained). ARB concluded that excepting the five and six year old vehicles in enhanced areas would result in emission losses of approximately four tons per day of HC and NOx by 2005. (See Section 3.3 for more details on this analysis.) In order to minimize the inconvenience to motorists throughout the State, staff believes that opportunities may exist for more targeted newer vehicle exceptions focusing on five and six year old vehicles expected to pass their initial inspection.

In 2004, DCA/BAR intends to use a low emitter profile (LEP) model as a "clean screen tool" to identify vehicles that could be excepted from their biennial inspection for their first six years because they are predicted to pass. Ideally, if the LEP worked perfectly, all vehicles excepted would have passed their Smog Check inspections, and there would be no foregone emission reductions resulting from the exceptions. However, in practice, some small fraction of vehicles excepted by the LEP would have failed their Smog Check inspections because there are always outliers even among engine families that are identified as clean. Any resulting emissions

increase would need to be mitigated through other means to ensure that a clean screen program does not interfere with California's plan to meet the federal air quality standards. These could include early vehicle retirement, engine replacement projects such as those funded through the Carl Moyer Program, or other air quality improvement projects such as those funded by air districts using motor vehicle registration fees.

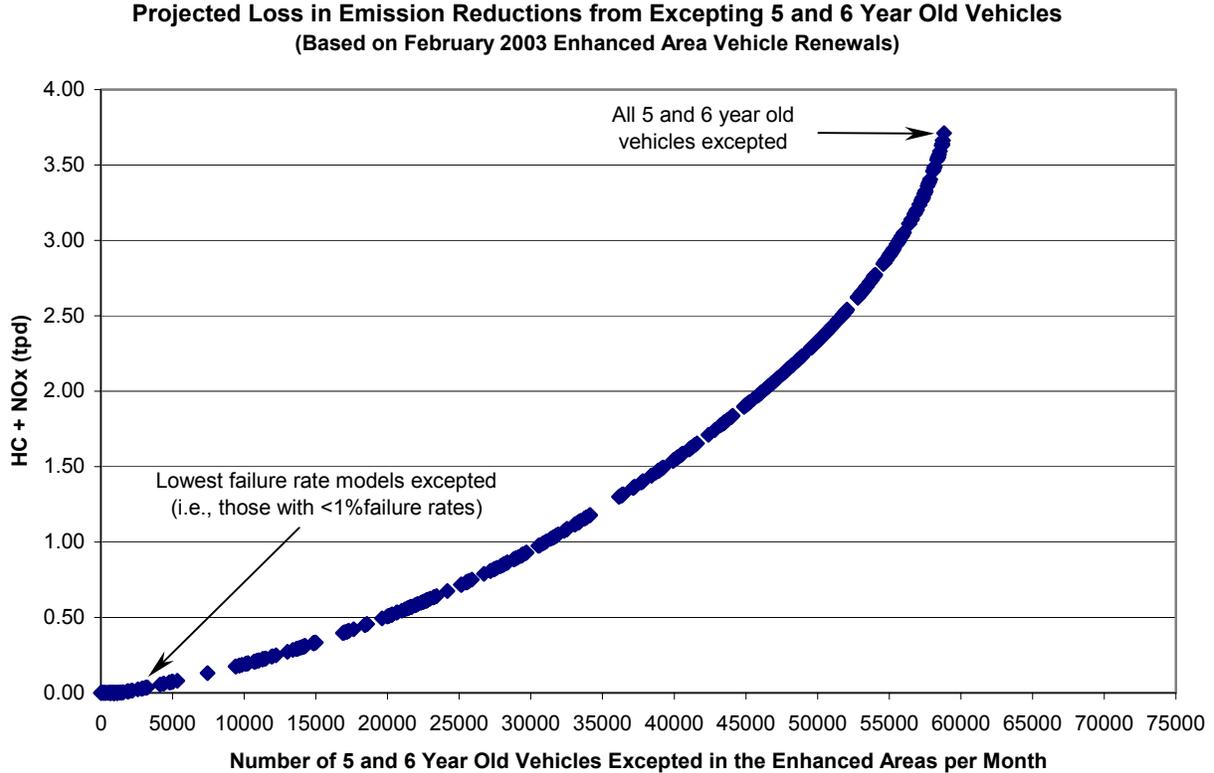
Evaluation: In May 2003, DCA/BAR began processing data for development of a LEP model. The model will be very similar to early versions of the High Emitter Profile (HEP) currently used to direct vehicles to Test-Only stations in the enhanced areas of California. However, instead of ranking vehicles according to the probability that they will have high excess emissions, as the HEP does, it would rank vehicles according to the probability that they will have low emissions and will pass their Smog Check inspection.

Both generic and specific data on the fleet can be used to predict whether a vehicle will be a low emitter or not. Generic information would include evaluating vehicle emissions on the basis of past performance of similar vehicles. Previous analysis has shown the historical failure rate on an engine family specific basis to be a strong predictor of vehicle emissions. Specific data includes previous Smog Check history on an individual vehicle (if available).

Recently, DCA/BAR examined historical Smog Check inspection records to estimate generic failure rates for the vehicles subject to California's Smog Check program. Predicted engine family specific ASM inspection failure rates for five and six year old cars range from zero percent to 21 percent based on Smog Check data from 2002. Models with very low failure rates are candidates for the LEP while models with failure rates of 10 or 20 percent would not be candidates to be clean screened.

Figure 4.1 shows the projected loss in emission reductions (HC and NO<sub>x</sub>) that is expected to occur in 2005 when specified numbers of five and six year old vehicles are excepted from the biennial inspection requirement under a LEP scenario in which the cleanest vehicles are excepted first. For example, if 20,000 vehicles (about one-third of the five and six year old fleet) were excepted each month in the enhanced areas for one biennial cycle using a LEP, the emissions impact is expected to be about 0.5 tpd (HC and NO<sub>x</sub>) in 2005. If 32,000 vehicles (about 54 percent of five and six year old vehicles) were excepted each month, emissions would increase by one tpd (HC and NO<sub>x</sub>) in 2005. For comparison, if all five and six year old vehicles were excepted, the emissions impact would be about four tpd.

Figure 4.1



A simple LEP model could be developed using a ranking system based on this generic vehicle data. Over time, a more detailed statistical model could be designed using all available data. Once the model has been developed and its performance evaluated, the percent of five and six year old vehicles that can be clean-screened with the least impact on anticipated emission reductions can be determined.

To summarize, the capability exists to identify vehicles within the five and six year old vehicle model year group with the lowest failure rates through a LEP. DCA/BAR could design a voluntary program that uses a LEP to except five and six year old vehicles predicted to pass their Smog Check inspection. Owners of five and six year old vehicles identified as “clean” by a LEP could be offered the opportunity to participate in a clean screen program in which they pay a fee in lieu of having a Smog Check. Presumably, the fee would be less than the cost of a Smog Check, so the consumers would benefit by saving both time and money. Because the LEP would not work perfectly in practice, a small fraction of vehicles would be misidentified as clean. The fees collected from consumers opting out of their Smog Check would be used to mitigate any loss in emission benefits through other means. A change in State law would be required to authorize DCA/BAR to collect such a fee.

Recommendation: Develop a method for excepting the portion of five and six year old vehicles projected to have the lowest emissions and thus the greatest likelihood of passing the Smog Check test. Inevitably, the method will except some vehicles with high emissions that will not be repaired. To avoid a loss of emission reductions, staff recommends that DCA/BAR be

granted the authority to charge a small fee to those owners who choose to have their vehicles excepted from their biennial inspection. The fee would be used to fund other programs, such as vehicle scrappage or the Carl Moyer program, that achieve emission reductions.

**Recommendation #1** – Design a program to offer motorists whose five and six year old vehicles are predicted to pass the biennial Smog Check, based on a LEP, the opportunity to participate in a clean screen program. DCA/BAR should be authorized to charge owners of any excepted vehicles a fee and to use the funds generated to fully offset any foregone emission reductions. This would require a change in State law.

Consumer/Industry Impacts: Vehicle owners participating in the voluntary “clean screen” program would save both time and money by paying a fee in lieu of their Smog Check, presuming the fee paid would be less than the cost of a Smog Check inspection. Given the time and cost savings as well as the voluntary nature of the program, consumers are expected to support this recommendation. However, this change could potentially result in a loss in revenue for Smog Check station owners. If, for example, one-third of the five and six year old fleet were excepted in the enhanced areas, there would be 240,000 fewer inspections conducted annually. This equates to about three percent of the 7.2 million inspections conducted annually in enhanced areas based on DCA/BAR data for 2002. The corresponding annual loss in revenue to station owners would be about \$11 million assuming an average test cost of about \$46 based on 2002 DCA/BAR data. (This analysis assumes only a loss in test revenue, but no loss in repair revenue since only vehicles expected to pass their inspection would be offered the “clean screen” alternative.)

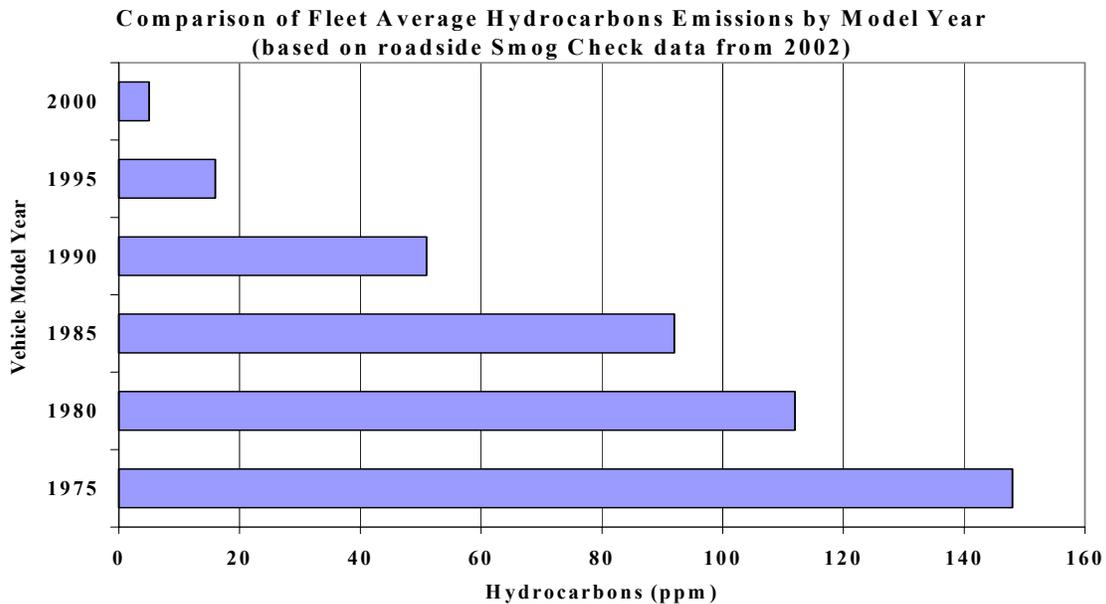
### **4.3 Eliminate the Existing 30-Year Rolling Exemption**

Background: In 1997, the Legislature modified the Smog Check program to exempt pre-1974 vehicles from the program. Beginning in January 2003, this legislation exempts motor vehicles 30 or more model years old from the Smog Check program. The range of model years exempted shifts annually. Hence, this has become known as the “30-year rolling exemption.” (In 2003, 1975 to 1999 model year vehicles were subject to testing pursuant to the biennial Smog Check program, and in 2004, 1976 to 2000 model year vehicles are subject to the program.) Prior to the 1997 legislation, only pre-1966 model years had been exempt from the program.

Because older vehicles contribute a disproportionate amount of emissions despite their relatively low numbers and use, excluding older vehicles from the program reduces the effectiveness of the Smog Check program. Figure 4.2 shows the relative HC emissions of vehicles by model year, based on roadside Smog Check data. An average 1975 model year car emits about 30 times more HC than a 2000 model year car. Pre-1976 model year cars account for 19 percent of the HC and eight percent of the NO<sub>x</sub> emissions from the light-duty fleet in 2004 despite accounting for only about 2.4 percent of the vehicle population and 1.2 percent of the miles traveled (based on the EMFAC2002 model). A similar distribution of emissions is projected in future years. For example, in 2010, pre-1982 cars (i.e., those exempt in 2010) are projected to account for 22 percent of the HC and 11 percent of the NO<sub>x</sub> emissions from the light-duty fleet despite

accounting for only about 2.6 percent of the vehicle population and 1.3 percent of the miles traveled.

**Figure 4.2**



The impact of exempting only the pre-1976 vehicles will lessen over time due to vehicle retirement. However, the 30-year rolling exemption essentially institutionalizes the loss in emission reductions.

Evaluation: There are two approaches to “recover” the lost emission benefits, each of which would require a statutory change by the Legislature: (1) repealing the rolling exemption and replacing it with a pre-1976 exemption so that no additional model years will be exempt, or (2) repealing the rolling exemption and replacing it with a pre-1966 exemption as had existed prior to the most recent legislative change. Staff estimated the 2010 emission benefits in enhanced areas for each of these options. (2010 was selected because it is the South Coast’s attainment date for the federal one-hour ozone standard, a critical milestone for achieving additional emission reductions.)

Table 4.1 presents the estimated 2010 emission benefit of eliminating the current 30-year rolling exemption and replacing it with an exemption for pre-1976 model years. If this change were implemented, approximately 340,000 additional model year 1976-1981 vehicles would remain in the program in 2010 compared to current provisions which would only require Smog Checks for 1982 and newer model year vehicles.

**Table 4.1: 2010 Emission Benefits for Enhanced Areas from Replacing 30-Year Rolling Exemption with a Pre-1976 Model Year Exemption (Keeping Model Years 1976-1981 in the Program in 2010)**

HC (tpd)	NO <sub>x</sub> (tpd)
2.7	3.0

The cost effectiveness of this program improvement is estimated to be a favorable \$7,900 per ton. This cost effectiveness is calculated by dividing the program improvement costs by the combined HC and NO<sub>x</sub> benefits using the same calculation method, and ASM inspection and repair costs, as the analysis of the current enhanced program presented in Section 3.4. This analysis assumes a statewide initial test failure rate of about 30 percent, which is based on data for model years 1976 through 1981 from the Fiscal Year (FY) 2001 DCA/BAR Executive Summary report.

Table 4.2 shows the estimated 2010 emission benefits of including 1966 to 1975 model year vehicles in the enhanced Smog Check program as originally envisioned in the 1994 SIP. The size of the 1966-1975 model year fleet in enhanced areas is estimated to be about 470,000 vehicles in 2003, dropping to about 240,000 vehicles in 2010 due to fleet turnover.

**Table 4.2: 2010 Emission Benefits for Enhanced Areas from Adding 1966-1975 Model Year Vehicles to the Program**

HC (tpd)	NO <sub>x</sub> (tpd)
7.6	3.3

Because the pre-1976 vehicles have already been exempted, reintroduction of these vehicles into the biennial inspection cycle might result in relatively high failure rates and associated high repair costs. In addition, consumers owning pre-1976 vehicles might feel like a new burden is being imposed on them and strongly oppose the change. On the other hand, repeal of the rolling exemption should not generate the same level of opposition because the vehicles that would be affected are currently included in the biennial inspection cycle. Because these vehicles have not been exempted yet, repealing the exemption would not impose a new requirement upon these vehicle owners.

Recommendation: Replace the current 30-year rolling exemption with a pre-1976 model year exemption. This would require a change in State law. Because 1976 models are not exempt under current law until 2005, no new requirements would be imposed on vehicle owners that they are not already facing. The California I/M Review Committee made the same recommendation at its May 29, 2003 meeting, and ARB had previously identified this as a potential program improvement in its July 2000 report evaluating the enhanced Smog Check program.

At this time, staff is not recommending that pre-1976 vehicles be reintroduced back into the program because this change might result in high failure rates and high repair costs and may be strongly opposed by consumers. However, such a change would result in significant emission reductions as shown in Table 4.2. With the daunting need for emission reductions to meet California's health-based air quality standards, adding these vehicles to the program could be considered at some point in the future. The use of remote sensing to identify the highest emitting pre-1976 vehicles may provide an alternative method of reducing some of these emissions. ARB and DCA/BAR will provide an assessment and recommendation upon completion of the joint remote sensing study currently being conducted.

**Recommendation #2** – Eliminate the 30-year rolling exemption and replace with an exemption for pre-1976 model year vehicles. This would require a change in State law.

Consumer/Industry Impacts: This change would affect the owners of older vehicles that are currently in the Smog Check program but would become exempt in future years under the current provisions of State law. No previously exempted vehicles would be reintroduced. By 2010, 340,000 additional model year 1976-1981 vehicles would remain in the Smog Check program compared to the current 30-year rolling exemption if this change went into effect in 2005. This would mean about 170,000 additional Smog Check inspections in 2010 (since inspections are required biennially). Assuming an average Smog Check cost of \$46 for the inspection (based on 2002 DCA/BAR Executive Summary report), an average repair cost of \$143 (based on 2002 DCA/BAR Executive Summary report), and a failure rate of about 30 percent for these older vehicles, consumers would continue to pay for an estimated \$7.8 million in testing and approximately \$7.5 million for repairs to these vehicles in 2010. (Please note, this preliminary analysis relies on 2002 cost estimates. Projected test and repair costs for 2010 have not been estimated.) Some motorists would qualify for financial assistance through the Consumer Assistance Program thus lowering the estimated repair costs. Benefits for consumers whose vehicles receive Smog Check repairs include better running vehicles and improved fuel economy.

While this change would potentially subject consumers to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the 2010 estimates cited above, the industry would potentially realize additional test and repair revenues of \$15 million.

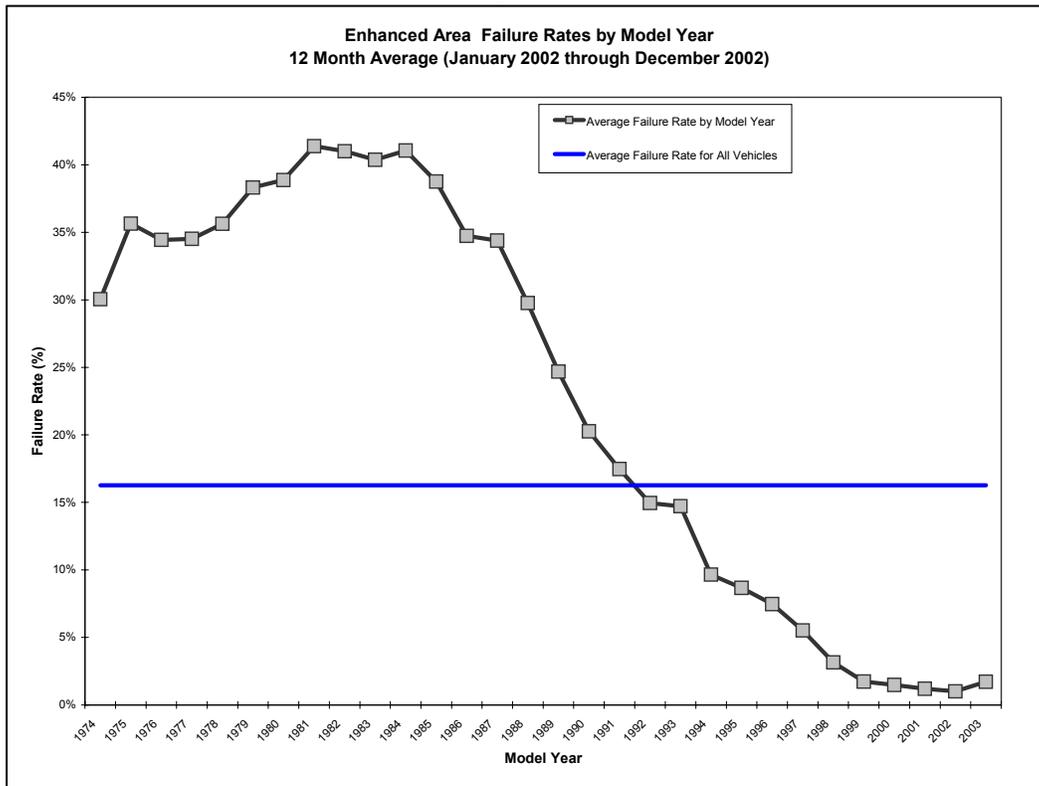
#### **4.4 More Frequent Inspections for Older Vehicles**

Background: Currently, California vehicles are required to undergo Smog Check testing every two years or upon change of ownership of the vehicle. Many I/M programs nationally inspect vehicles once a year; some vary the test cycle by vehicle age and emissions technology. If older vehicles that have the greatest likelihood of failing were inspected annually instead of biennially, additional emission benefits could be realized by shortening the time that vehicles are emitting excess emissions prior to being repaired.

The key to successfully adding an annual testing component to the enhanced Smog Check program would be to focus the annual inspections on the small subset of the fleet that has the greatest chance of failing. This would allow additional emission reductions to be achieved while subjecting a minimum number of consumers to the inconvenience of annual testing.

Evaluation: As vehicles age and deteriorate, they tend to fail their Smog Check inspections more frequently. This point is demonstrated in Figure 4.3 which shows average ASM test failure rates by model year based on Smog Check program data collected during calendar year 2002. While the overall failure rate averages about 16 percent, the failure rate rises sharply with vehicle age. At 11 or 12 years of age (model years 1991 and 1992 in Figure 4.3), vehicles fail at a rate that is about equal to the overall fleet failure rate. However, by the time vehicles reach 15 years of age (model year 1988 in Figure 4.3), the failure rate rises to 30 percent, about twice the overall fleet failure rate. The failure rate rises as high as 40 percent for vehicles from the early-1980s. Additional emission reductions would be achieved if the vehicles with higher failure rates are subject to more frequent inspection and repair.

**Figure 4.3**



To illustrate the potential emission benefits of requiring annual testing for older vehicles, staff estimated the emission benefits of requiring annual instead of biennial testing for vehicles over 15 years old. Fifteen years of age was selected as an example because this is the point at which vehicles start failing at a rate twice the fleet average. In addition, the vehicles older than 15 years accounted for less than 25 percent of the Smog Check tests performed in the past year. Thus, over 75 percent of vehicle owners would be unaffected by the change. If DCA/BAR were to implement an annual testing program for older cars, the exact vehicle age at which to start

such a requirement would be determined based on factors such as cost effectiveness, the number of consumers affected, and the achievable emission reductions.

Table 4.3 shows the estimated 2005 and 2010 emission benefits of requiring annual testing of vehicles over 15 years old based on ARB’s EMFAC2002 emissions model. The analysis assumes that the provision for annual testing of vehicles over 15 years old would roll forward each year, meaning that, if it started in 2004, it would affect model years 1976-1989 and, in 2010, it would affect model years 1982-1995 (assuming no changes to the 30-year rolling exemption). In 2005, this provision would affect about 4.4 million vehicles, and in 2010, it would affect about 5.4 million vehicles. The benefits shown in Table 4.3 would be greater if this program improvement were implemented in conjunction with replacing the 30-year rolling exemption with an exemption for pre-1976 model year vehicles only.

**Table 4.3: Emission Benefits for Enhanced Areas from Requiring Annual Inspections for Vehicles Over 15 Years Old (assuming no change to 30-year rolling exemption)**

Year	HC (tpd)	NOx (tpd)
<b>2005 Emission Benefits</b> (annual testing for 1977-1990 model year vehicles)	10	15
<b>2010 Emission Benefits</b> (annual testing for 1982-1995 model year vehicles)	9.4	18

It is appropriate to roll the annual testing provision forward each year at least for several years under the assumption that pre-1996 cars will continue to deteriorate at a rate similar to that seen today. However, it may not be appropriate to require annual testing once newer cars (those manufactured starting in the mid-1990s) reach the age at which annual testing would be required. These vehicles, subject to the Low Emission Vehicle program requirements and equipped with OBD II (starting in 1996), were initially cleaner than previous model years and have more sophisticated emissions controls in place. A decision to inspect these newer cars annually as they age could be decided once data on their in-use performance are available.

An annual testing program for older vehicles would be most efficient and effective if it is targeted at the cars most likely to fail their Smog Check. While the failure rates for cars older than 15 years are 30-40 percent – over twice the fleet average failure rate, a majority (60-70 percent) of these vehicles still pass their Smog Check tests. DCA/BAR would implement an annual testing program for older vehicles in conjunction with a “clean screen” program to except a fraction of the older vehicles that have the highest likelihood of passing the Smog Check inspection from the annual testing requirement. These vehicles would still be subject to the current biennial testing requirement. Such a provision would minimize the impact on consumers and improve the cost-effectiveness of this program improvement by focusing the annual testing requirement only on those vehicles that are expected to fail the test.

DCA/BAR is considering two “clean screen” approaches. A LEP could be developed based on historical Smog Check data, similar to the approach for excepting the cleanest five and six year

old vehicles. (See Section 4.2 for more details.) It may also be possible to use remote sensing to “clean screen” vehicles. ARB and DCA/BAR have started a pilot study to evaluate the appropriate uses of remote sensing in the Smog Check program. Once this pilot study is complete, ARB and DCA/BAR will be able to determine how remote sensing could be used to target the annual testing requirement most effectively.

To illustrate the potential cost effectiveness of an annual testing program for older vehicles, staff estimated the cost-effectiveness of requiring annual testing for vehicles over 15 years old to be less than \$10,000 per ton if all vehicles were subject to the requirement. As noted above, the cost effectiveness would improve by “clean screening” the vehicles that are most likely to pass their Smog Check inspections.

Recommendation: Implement an annual inspection program for older vehicles. DCA/BAR would implement an annual testing program for older vehicles in conjunction with a “clean screen” program to exempt a fraction of the older vehicles that have the highest likelihood of passing the Smog Check inspection from the annual testing requirement. More frequent inspections would require a change in State law. If DCA/BAR were to implement an annual testing program for older vehicles, the exact vehicle age at which to start such a requirement would be determined based on factors such as cost effectiveness, the number of consumers affected, and the achievable emission reductions.

<p><b>Recommendation #3</b> – Provide authority to require annual inspections of older vehicles, and implement an annual testing program in conjunction with a “clean screen” element to focus the requirement on the vehicles most likely to fail. This would require a change in State law.</p>
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Consumer/Industry Impacts: Owners of older vehicles subject to annual inspection under this change would incur additional testing costs and may incur additional repair costs (if their vehicles failed the inspection). To minimize consumer impact, this change would be implemented with a “clean screen” element to focus the annual testing requirement on vehicles most likely to fail. Because specific implementation details such as the model years subject to annual testing and the fraction of vehicles to “clean screen” have not yet been resolved, the exact cost to consumers has not yet been estimated.

To provide an upper bound of potential consumer cost, staff has estimated the additional cost if all vehicles 15 years and older were subject to annual testing, without a “clean screen” element. About 4.4 million vehicles (or 20 percent of the enhanced program fleet) will be 15 years or older in 2005. Under the current biennial testing requirements, 2.2 million of these vehicles are tested each year. With an annual testing requirement, an additional 2.2 million vehicles would be tested each year. Assuming an average Smog Check cost of \$46, an average repair cost of \$143, and an annual failure rate of about 23 percent for these older vehicles, consumers would potentially pay \$101 million in testing and \$72 million in repairs annually. Some motorists would qualify for financial assistance through the Consumer Assistance Program, thus lowering the estimated repair costs. Actual costs and the number of impacted consumers are expected to be substantially lower with an effective “clean screen” provision.

Motorists whose vehicles are repaired earlier than they would have been under the existing program would reap several benefits, including better running vehicles, improved fuel economy, improved vehicle operation and reliability, thereby increasing the likelihood of passing their next Smog Check inspection.

While this change would subject consumers to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the bounding assumptions cited above, the industry could potentially realize additional revenues of \$173 million annually from the 2.2 million additional tests and the associated repairs for failing vehicles.

#### **4.5 Annual Testing for High Mileage Vehicles**

Background: Recognizing that vehicles driven high miles annually need more frequent inspections (and repairs) to minimize emission outputs, DCA/BAR was provided the authority in 1994 to require annual testing of high mileage fleet vehicles. However, the statutory provision is limited to only those vehicles owned by businesses that voluntarily elect to participate in DCA/BAR's business fleet program. Thus, implementation of the current provision would impact only a portion of the high mileage vehicles, and provides a disincentive to participate in the business fleet program.

Evaluation: As part of an ongoing effort to determine whether high mileage fleets (such as taxicabs) are being adequately maintained to prevent excessive emissions, ARB conducted a voluntary inspection program of taxicab fleets in the San Francisco and Los Angeles areas during 2002. The program was designed to identify the fraction of the taxicab fleet with excess emissions, the potential emission benefits from more timely repairs, and potential changes to the Smog Check program that could address these excess emissions.

Under the program, ARB conducted approximately 1,600 vehicle inspections on 1992-2002 model year taxicabs. Some of these inspections were scheduled in advance with the fleet operator and others were unannounced inspections of randomly selected vehicles. Inspections were designed to match the visual portion of the State's Smog Check test. Each vehicle received a visual inspection to determine the condition of emission control system components, including the air injection system, catalytic converter, evaporative emission system, exhaust gas recirculation system, oxygen sensor, positive crankcase ventilation system, and other components monitored by the onboard diagnostic (OBD) system and its associated malfunction indicator light. In addition, for vehicles equipped with OBD II (1996 and newer model year vehicles), the vehicle's engine operational parameters and diagnostic information were retrieved using an OBD II diagnostic scan tool. Approximately 75 percent of the vehicles inspected were equipped with OBD II.

Table 4.4 presents the results of these inspections. The overall failure rate was about 27 percent, with a "failure" meaning that one or more of the emission control system components was non-operational either due to deterioration or tampering.

**Table 4.4: Number of Failing Inspections By Inspection Type**

<b>All Inspections</b>	<b>Scheduled Inspections</b>	<b>Random Inspections</b>
432 out of 1602 (27%)	257 out of 1158 (22%)	175 out of 444 (39%)

To put these extremely high failure rates in perspective, ARB compared the failure rate observed in the taxicab fleet with the failure rate observed in the overall fleet through Smog Check testing using the most recent year of Smog Check data (collected between May 2002 and April 2003). While 27 percent of the taxicabs failed their inspections during this study, the overall failure rate for the entire fleet is about 16 percent. Furthermore, the overall fleet failure rate for 1992-2002 models (vehicles the same age as the taxicabs tested) is only around five percent.

One reason for the vast disparity in failure rates between taxicabs and the overall fleet is the high mileage driven by taxicabs. Based on data collected during this inspection program, ARB estimates the average taxicab miles traveled in 2002 to be 58,000 miles per year. This is at least four times the mileage that an average passenger car drives. With taxicabs accruing mileage at a much higher rate and Smog Checks occurring only once every 116,000 miles on average (versus once every 20,000-30,000 miles for a typical car), emission control components will deteriorate and fail at a higher rate. This suggests that biennial Smog Check testing is not sufficiently frequent to diagnose excess emissions in high mileage vehicles in a timely manner. Annual testing would limit the amount of time before excess emissions are identified and fixed. ARB's study focus began with taxicabs, but has expanded in 2003 to include other high mileage fleets such as shuttle-type vehicles, limousines, and other privately owned commercial transportation vehicles. Preliminary data collected for shuttle vans indicate failure rates similar to those seen for taxicabs.

As part of this inspection program, ARB tested the exhaust emissions of 43 OBD II equipped taxicabs to estimate the overall emissions of the taxicab fleet and the emission benefit from repairing failing vehicles. Test vehicles were divided into two groups: (1) 28 vehicles with no OBD indicated failures (i.e., malfunction indicator light off) that were tested to establish the baseline emission rate; and (2) 15 vehicles with OBD failures (i.e., malfunction indicator light on) that were tested before being repaired and then tested after repairs were made to fix the fault codes indicated by the OBD II system.

Based on the before and after repair test data, failure rate data for OBD II vehicles, and annual taxicab miles traveled data collected during the inspection program, ARB estimated the potential emission benefits from inspecting and repairing failing taxicabs more frequently. Assuming that the failure rate observed in San Francisco and Los Angeles taxicab fleets during this inspection program is the same for the statewide taxicab fleet of about 20,000 vehicles based on Department of Motor Vehicle (DMV) estimates, ARB estimated the potential statewide emission benefits from requiring more frequent inspection and repair of taxicabs as shown in Table 4.5.

**Table 4.5: Potential Emission Reductions from More Frequent Inspections of Taxicabs**

<b>HC (tpd)</b>	<b>CO (tpd)</b>	<b>NOx (tpd)</b>
0.2	3.6	0.6

While these overall emission reductions are not large, they are quite high on a per vehicle basis considering that the taxicab fleet comprises only 20,000 vehicles. Furthermore, taxicabs are only one example of the high mileage fleets operating in California. A review of the Smog Check test data for 2002 suggests that up to three percent of the fleet was driven high mileage, that is more than 25,000 miles per year. If the estimated reductions from 20,000 taxicabs are ratioed to the three percent of the enhanced program area fleet driven high mileage, the resulting emission reductions would be 6 tpd HC, 102 tpd CO, and 17 tpd NOx. This provides a rough estimate of potential benefits from more frequent testing of all high mileage vehicles. It should be noted that this is an upper bound of potential benefits; not all these vehicles drive as many miles as the 58,000 miles driven annually on average by taxicabs, so the actual benefits would be somewhat lower than those presented above.

Based on the emissions data from the taxicab study and average test and repair costs, the cost-effectiveness of requiring annual Smog Check inspections for taxicabs instead of biennial inspections is estimated to be \$6,900 per ton.

Recommendation: Based on the analysis summarized above, the current biennial inspection requirements should be amended so that the State is given the authority to require more frequent inspections of all high mileage vehicles that are traveling more than twice the average miles per year.

**Recommendation #4** – Provide authority to require more frequent inspections of all vehicles traveling more than twice the average miles per year of the California fleet. This would require a change in State law.

Consumer/Industry Impacts: Under this change, owners of vehicles that travel at miles more than twice the fleet average could potentially be subject to annual inspection in which case they would incur additional testing costs and may incur additional repair costs (if their vehicles failed the inspection). Because specific implementation details have not yet been worked out, the exact number of vehicle owners affected and the associated costs have not yet been estimated. For example, DCA/BAR may start implementation by focusing on fleet vehicles with potentially high annual mileage, instead of focusing on individually owned vehicles which may be more difficult to identify.

As in the previous section, staff has estimated the additional cost if all “high mileage” vehicles were subject to annual testing in order to provide an upper bound of potential costs to vehicle owners. About three percent of the fleet, or 560,000 vehicles in enhanced areas, accumulate greater than 25,000 miles per year. Under the current biennial testing requirements, only half these vehicles would be required to have a Smog Check each year. With an annual testing requirement, an additional 280,000 would be tested each year. Assuming an average Smog Check cost of \$46, an average repair cost of \$143, and a failure rate of about 27 percent for these high mileage vehicles (which is the average failure rate observed in ARB’s taxicab study), vehicle owners could potentially pay \$13 million in testing and \$11 million in repairs annually. Some motorists would qualify for financial assistance through the Consumer Assistance Program thus lowering the estimated repair costs.

Vehicle owners whose vehicles are repaired earlier than they would have been under the existing program would reap several benefits, including better running vehicles, improved fuel economy, improved vehicle operation and reliability, thereby increasing the likelihood of passing their next Smog Check inspection. While this change would subject some vehicle owners to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the bounding assumptions cited above, the industry could potentially realize additional revenues of \$24 million annually from the 280,000 additional tests and the associated repairs for failing vehicles.

## **4.6 Station Performance**

The next four sub-sections present an evaluation of Smog Check station performance. The first sub-section (Section 4.6.1) compares the ability of Test-Only and Test-and-Repair stations to properly identify polluting vehicles. The second sub-section (Section 4.6.2) contains an evaluation of the quality and durability of Smog Check repairs. Based on the findings from these analyses, staff evaluated potential program changes that would improve station performance. The third sub-section (Section 4.6.3) presents an evaluation of one approach for improving the quality of repairs – setting more stringent post-repair cutpoints in order to ensure more complete repairs of vehicles’ emission control systems. The fourth sub-section (Section 4.6.4) includes an evaluation of the Smog Check enforcement program and presents recommendations for improving the quality of repairs and overall station performance. The final sub-section (Section 4.6.5) contains a summary of the major findings of this station performance analysis.

### **4.6.1 Comparison of Test-Only and Test-and-Repair Stations**

Background: There are about 8,000 Smog Check stations operating statewide, of which 6,600 are in the state’s enhanced areas (including the recent addition of the Bay Area to the enhanced program). Stations and technicians are responsible for properly inspecting and repairing vehicles that have tampered or defective emission control systems. Failure to perform proper inspections and repairs results in a loss of potential emission reductions from the Smog Check program. To ensure that inspections are performed properly, DCA/BAR pursues disciplinary actions against stations and technicians for violations of the Smog Check program laws and regulations.

One element of California’s enhanced Smog Check program is the use of Test-Only stations for inspecting a portion of the enhanced area fleet. Test-Only stations are licensed by DCA/BAR to perform tests on vehicles, but are prohibited from performing any repair services. Test-and-Repair stations are licensed by DCA/BAR to perform both tests and repair services. The most likely to fail vehicles are directed by DCA/BAR to Test-Only stations where they are believed to obtain a more unbiased inspection. This provision is fundamental to the design of the current enhanced Smog Check program and was the feature that allowed California to receive U.S. EPA approval of its program and avoid Test-Only inspections for all vehicles.

Evaluation: Two approaches were used to compare the performance of Test-Only and Test-and-Repair stations. The first approach relies on a statistical ranking methodology to categorize

stations into “high performing” or “low performing” stations. This method<sup>3</sup> compares observed and expected inspection failure rates for each station, then ranks each station based on the result. Stations reporting failure rates that meet the expected failure rate are doing the best job identifying polluting vehicles. Stations that are failing fewer vehicles than would be expected have a greater likelihood of inappropriately passing vehicles that should fail Smog Check.

This approach was used to evaluate station performance based on Smog Check data collected in both 1999 and 2001. Table 4.6 shows the percent of stations and percent of vehicles inspected in each ranking category. Both the 1999 and 2001 data show similar station performance patterns even though more vehicles were directed to Test-Only stations in the 2001 data set. In both cases, the majority of Test-Only stations (about 60 percent) were among the best performing stations, whereas only about 20 percent of the Test-and-Repair Stations were placed in the best performing category based on this measure. Test-and-Repair stations are more uniformly distributed among the “best” to “worst” categories.

**Table 4.6: Percent of Stations by Rank Using Smog Check Inspection Records (based on data collected in 1999 and 2001)**

1999 Evaluation				
Ranking (Percent)	Enhanced Test-Only		Enhanced Test-and-Repair	
	Percent of Stations	Percent of Vehicles Inspected	Percent of Stations	Percent of Vehicles Inspected
0 - 25 (Best)	59.9	12.8	21.2	19.3
25 - 50	21.5	3.6	25.4	17.3
50 - 75	12.3	2.5	26.4	18.1
75 - 100 (Worst)	6.3	1.4	27.0	25.0
All	100.0	20.2	100.0	79.8
2001 Evaluation				
Ranking (Percent)	Enhanced Test-Only		Enhanced Test-and-Repair	
	Percent of Stations	Percent of Vehicles Inspected	Percent of Stations	Percent of Vehicles Inspected
0 - 25 (Best)	58.1	19.2	19.8	16.2
25 - 50	18.9	4.5	26.1	12.9
50 - 75	12.4	3.0	27.1	14.9
75 - 100 (Worst)	10.6	3.6	26.9	25.7
All	100.0	30.4	100.0	69.6

A second measure used to evaluate station performance is a repeat emissions analysis. This analysis uses a statistical technique designed to identify stations with unusual clusters of distinctive emissions patterns. The occurrence of such similar emissions readings on initial test inspection data can be an indication of improper, or fraudulent, activity such as “clean piping” (testing the same clean vehicle in place of another vehicle(s) that may otherwise fail). Each station is assigned a repeat emission index score; with higher numbers representing better

<sup>3</sup> The June 27, 2000 report “Smog Check Station Performance Analysis” by Eastern Research Group (ERG) and de la Torre Klausmeier Consulting (dKC) contains the original ranking analysis based on 1999 data. The report found that much greater exhaust emission reductions were observed for vehicles certified at Test-Only stations than Test-and-Repair stations.

performance. Index scores near 100 indicate few incidences of repetitive emissions. On the other hand, scores near zero indicate a relatively large number of repetitive emissions.

Table 4.7 presents the repeat emissions analysis results, sorted by station type. Over 95 percent of Test-Only stations achieve a perfect score of 100 on the repeat emissions evaluation. In contrast, only 66 percent of Test-and-Repair stations achieve a perfect score. More importantly, 21 percent of Test-and-Repair stations are ranked very low on this index compared to only about one percent of Test-Only stations based on station data collected in 2001.

**Table 4.7: Repeat Emissions Analysis Results**

Repeat Emissions Index Score	Enhanced Test-Only	Enhanced Test-and-Repair
	Percent of Stations	Percent of Stations
<b>100 (Best)</b>	95.7	66.4
<b>Greater or equal to 15 and less than 100</b>	3.0	12.3
<b>Less than 15 (Worst)</b>	1.3	21.3
<b>All</b>	100.0	100.0

Based upon these results, nearly all Test-Only stations are performing according to expectations; however, one-fifth of the Test-and-Repair stations are not.

Conclusions: The two different analytical approaches both reveal that more Test-Only stations rank among the best performing stations when compared to Test-and-Repair stations in terms of identifying polluting vehicles.

- These results indicate that California’s Test-Only approach is working. Because the Test-Only stations are doing a better job of identifying failing vehicles (which leads to these vehicles being repaired), additional emission reductions are being achieved by directing vehicles to Test-Only stations.
- These results also support recent program changes that increased the fraction of vehicles directed to Test-Only for biennial inspections in the enhanced area fleet.
- These analyses show that a significant portion of stations is not performing as well as they should in identifying polluting vehicles.

In Section 4.6.4, changes to the Smog Check enforcement program that would improve the performance of stations that are not meeting expectations are recommended.

#### **4.6.2 Evaluation of Repair Effectiveness**

Background: The previous sub-section shows that some stations are not performing as well as others in identifying polluting vehicles. This section complements that analysis by evaluating another important element of station performance, the quality and durability of repairs. These factors directly impact the emission reductions achieved by the Smog Check program. If vehicle

repairs last for only a short time, the emission benefits associated with the repairs are lost quickly.

Evaluation: Both roadside data and Smog Check program data were used to evaluate the accuracy of station data as well as repair effectiveness. Roadside test data is considered a more accurate measure of program effectiveness than station data. Pre-inspection repairs, differences in station performance as well as fraudulent station/technician behavior can affect station data statistics. The following three comparisons for vehicles undergoing their biennial inspection as well as tested through the DCA/BAR roadside inspection program are provided.

The first comparison examines average emission rates for roadside vehicles following their Smog Check inspection result. Table 4.8 shows average roadside emission rates (ASM concentrations converted to FTP grams per mile) for vehicles after they had received an enhanced Smog Check. All average emissions results have been weighted by the appropriate model year travel fractions. Vehicles are grouped into those that failed their initial inspection, then passed after repairs and those that passed their initial inspection. On average, vehicles that pass their initial test have significantly lower emission rates than vehicles that were repaired to pass. If failing vehicles could be repaired such that their emission levels are closer to those of passing vehicles, additional emission reductions could be achieved. In Section 4.6.3, staff evaluated a potential program change that would help accomplish this.

**Table 4.8: Average FTP-Based Emission Rates For Roadside Vehicles Following Their Smog Check Inspection\***

<b>Smog Check Result</b>	<b>HC (g/mi)</b>	<b>CO (g/mi)</b>	<b>NOx (g/mi)</b>
Vehicles Failing Initial Inspection and Subsequently Repaired	1.09	13.53	1.16
Vehicles Passing Initial Inspection	0.76	9.93	0.88
Difference	0.33	3.60	0.28

\* Based on roadside vehicles tested between January 2000 and October 2002.

The second comparison looks at the subsequent roadside tailpipe failure rate relative to the after repair Smog Check tailpipe failure rate. Table 4.9 shows the subsequent roadside tailpipe failure rate for vehicles that initially failed, then passed their Smog Check. Vehicles selected had a roadside test within one year of the Smog Check inspection. If all of the repairs were successful and durable, the roadside failure rate would be near zero. However, based on roadside data collected in 2001, 40.4 percent of the repaired vehicles tested failed the subsequent roadside test. This suggests that many of the failing vehicles did not get repaired properly or the repairs did not last. The average after Smog Check roadside test was performed approximately five to six months after the passing Smog Check result, so some new defects may have occurred.

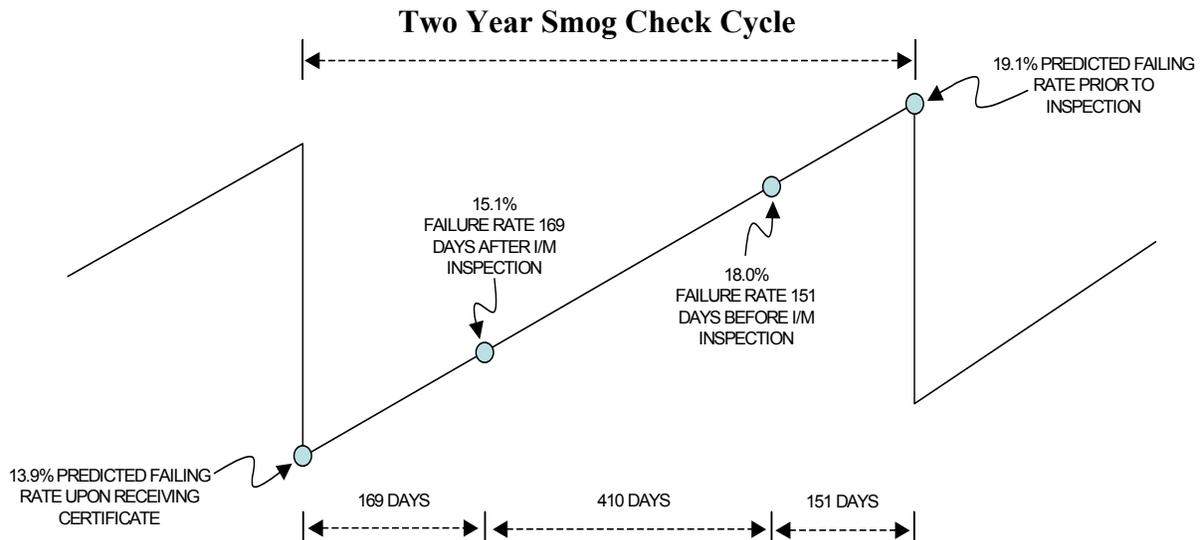
**Table 4.9: Roadside Failure Rate For Vehicles After Smog Check Repairs**

Roadside Testing of Vehicles After Failed Enhanced Smog Check and Subsequent Repair	Number of Vehicles	Roadside Failure Rate *
	735	40.4%

\* Weighted by the Vehicle Inspection Data (VID) model year distribution from December 2000 through November 2001.

The third comparison examines roadside tailpipe failure rates before and after Smog Check. Figure 4.4 shows the relationship between failure rate and time since/before Smog Check based on the roadside test results. This analysis considered vehicles where the roadside test occurred within one year of the Smog Check inspection. The average number of days “after” Smog Check for this data set is 169. The average number of days “before” Smog Check is 151. To estimate the before and after Smog Check failure rate at the time of the Smog Check, a linear extrapolation of the roadside data was performed. The linear extrapolation indicates that the failure rate immediately after Smog Check would be 13.9 percent and the failure rate for vehicles about to get a Smog Check would be 19.1 percent. If the relationship between failure rate and time since Smog Check is truly linear, this could indicate questionable test results. However, it is possible that more of the vehicles actually pass Smog Check after receiving ineffective or partial repairs and then deteriorate rapidly. Regardless of whether the deterioration is linear or non-linear, this analysis shows a significant portion of the vehicles that fail Smog Check are not effectively repaired.

**Figure 4.4  
Variation in Failure Rates For Vehicles Tested at the Roadside  
Before and After Biennial Smog Check**



**Conclusions:** The primary goal of the Smog Check program is identification and repair of polluting vehicles. The three comparisons above indicate vehicles are not being optimally repaired and maximum emission benefits are not being achieved.

- Analysis of Smog Check program data indicates final emissions for failing vehicles could potentially be lowered to the point that their emission levels are closer to those of passing vehicles.
- Analysis of Smog Check program data and roadside data show that repairs are not being adequately performed.
- Furthermore, Smog Check program data and roadside data show that vehicles passing Smog Check may have received ineffective or partial repairs and then deteriorated rapidly.

Several solutions have been identified to address the problems of poor performing stations and less than optimal repairs discussed above. These solutions include more stringent post-repair cutpoints (discussed in sub-section 4.6.3) and better/streamlined enforcement (discussed in sub-section 4.6.4).

### **4.6.3 More Stringent Cutpoints for After-Repair Tests**

Background: Analysis of Smog Check program data indicates that a significant portion of vehicles requiring repairs to pass Smog Check are likely to fail the next time they are tested (see Section 4.6.2). Since the overall program failure rate is less than 20 percent, this indicates that the repairs being performed are not suitably thorough. Many vehicles are only receiving partial, incremental repairs until they pass the test. When all emissions-related defects are not corrected, post-Smog Check deterioration in emissions control can rapidly occur. This is especially problematic in cases where the cause of excessive emissions, such as an intermittent misfire problem, is not eliminated. Installing a new catalytic converter on such vehicles may be sufficient to get them to pass the Smog Check test, but the continuing misfire causes rapid deterioration of the new catalytic converter and an increase in emissions. Additional emission reductions could be achieved if vehicle repairs are more complete and longer lasting.

Evaluation: Staff compared the average roadside emissions test results for vehicles that passed their initial Smog Check test to those that failed their initial test but subsequently received a Smog certificate (i.e., they were either repaired and passed, or issued a repair cost waiver<sup>4</sup>) as shown in Table 4.10. The roadside ASM emission test results have been converted to grams per mile values of the FTP to reflect on-road driving. All average emissions results have been weighted by the appropriate model year travel fractions. Comparison of the two sets of emissions results show that vehicles passing their initial Smog Check test have significantly lower emissions for all three pollutants than vehicles that fail initially but subsequently receive a certificate after being repaired. This difference in emission rates suggests the potential for failing vehicles to be repaired to lower emission levels than are currently being achieved.

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<sup>4</sup> Few repair cost waivers are being issued at present, most likely due to the availability of the Consumer Assistance Program. The current waiver rate is between 0.1-0.2 percent of the total inspections performed.

**Table 4.10: Comparison of Emissions Between Vehicles Passing Initial Inspection and Vehicles Failing Initial Inspection and Subsequently Receiving a Smog Certificate**

<b>Smog Check Result</b>	<b>HC (g/mi)</b>	<b>CO (g/mi)</b>	<b>NOx (g/mi)</b>
Vehicles Failing Initial Inspection and Subsequently Repaired	1.09	13.53	1.16
Vehicles Passing Initial Inspection	0.76	9.93	0.88
Difference	0.33	3.60	0.28

Based on roadside vehicles tested between January 2000 and October 2002.

There are several approaches to addressing incomplete repairs. One would be to increase the stringency of the inspection standards (cutpoints), which would force more thorough repair. However, this approach would also fail more vehicles on initial inspection. Some of these vehicles would have only marginally high emissions, resulting in less cost-effective repairs.

A second approach would be to establish an inspection standard for repair that is more stringent than the inspection standard used to determine if a vehicle initially passes or fails. This approach would not affect the number of vehicles initially failing the test. However, it would assure that those vehicles that fail are more fully repaired and likely to remain lower emitters for a longer time.

In order to estimate the emission reductions associated with more stringent post-repair cutpoints, the level of the cutpoints would need to be known. At this time, DCA/BAR has not completed an assessment of the levels at which post-repair cutpoints should be set. This assessment will include a thorough evaluation of the emissions levels that can be achieved in practice with reasonably priced repairs and the need to ensure that cutpoints are not set at levels that cannot be achieved.

It is important to note that excess emissions targeted under this potential change to the Smog Check program are also targeted under a control measure in the 2003 SIP revisions for the South Coast and San Joaquin Valley. In SIP measure LT/MED-DUTY-1, ARB is evaluating the feasibility of a statewide program that would require the replacement of emission control components on older passenger cars. If such a program were implemented, some of the reductions would overlap with those from this Smog Check change. Staff will take this into account in estimating the emission benefits from each program.

Conclusion: Given the potential benefits associated with applying more stringent standards for the after-repair test, DCA/BAR is planning to evaluate a program change that would require separate standards for the after-repair test, under its current statutory authority. In addition to providing additional emission reductions, this change would protect consumers by helping to ensure that emission defects are fully repaired. This should reduce the number of repaired vehicles that fail their next Smog Check as a result of incomplete repairs. Once DCA/BAR finishes its evaluation of the level at which post-repair cutpoints could be set, it will provide an estimate of the associated emission reductions and a cost effectiveness estimate as part of any regulatory proposal to implement this program change.

DCA/BAR is planning to evaluate a change to the Smog Check program that would set more stringent post-repair cutpoints in order to ensure more complete and durable repairs of vehicles that fail Smog Check.

Consumer/Industry Impacts: This change would not require any additional or more frequent inspections nor would it result in any additional failing vehicles. However, it would subject a fraction of the 1.1 million consumers whose vehicles fail their enhanced Smog Check inspection each year to additional repair costs. The exact number of consumers affected and the associated costs can only be estimated once the specific post-repair cutpoint levels are determined. Currently, some failing vehicles are repaired to levels well below existing cutpoints. If post-repair emission levels of these vehicles are below the new cutpoints, these consumer would not be impacted by this program change. However, other vehicles, such as those repaired to levels just below the current cutpoints, would likely require additional repairs to pass the more stringent cutpoints. These consumers would potentially incur additional costs. However, these motorists would also benefit from fully repaired emission defects, resulting in better performance as well as more durable repairs.

With respect to the Smog Check station industry, there would be no impact on the number and cost of inspections. However, additional repair revenue would likely be generated for the Smog Check repair industry because this change may result in more comprehensive repairs for a fraction of the failing vehicles. The consumer and industry impacts will be thoroughly and quantitatively evaluated as DCA/BAR develops a detailed proposal for this program change.

#### **4.6.4 Improving Station Enforcement Actions**

Background: DCA/BAR tracks “poor performing” stations through traditional enforcement operations. Stations are targeted based on criteria including: quality assurance inspections; consumer complaints; anonymous complaints; and/or anomalous activity in the station’s Smog Check inspection records. These investigations can range from overt fact finding to covert methods, including surveillance and the use of documented undercover vehicles. Resulting actions range from official conferences to fines to license revocation and finally to criminal penalties for technicians or station owners convicted of fraud. The successful prosecution of cases involves the coordination of three State agencies: DCA/BAR; the Attorney General’s (AG’s) Office; and the Office of Administrative Hearings (OAH). This section includes an evaluation of the Smog Check enforcement program and presents recommendations for improving enforcement. Better enforcement provides a mechanism to improve the performance of stations in both identifying polluting vehicles and repairing them.

Evaluation: DCA/BAR relies on the Licensing Section of the Civil Division of the AG’s office for both the preparation of formal accusations and the legal representation in the adjudication of administrative actions. The Licensing Section of the AG’s office consists of approximately 100 Deputy Attorneys General statewide that represent some 34 State agencies in taking administrative action against holders of professional and vocational licenses. During FY 2001/2002, the AG’s Licensing Section caseload consisted of more than 3,000 filings for administrative action. The initiation of the administrative disciplinary process begins with the

preparation and serving of an accusation, which is a formal document containing the charges against a licensee. DCA/BAR is among 33 other State agencies that contribute to the AG's annual workload and it is not uncommon for the preparation and serving of an accusation to take as much as eight to 12 months once a case has been forwarded for representation.

The time frame for the processing of cases at the AG's office has also been impacted by civil litigation in which the AG's office has represented the DCA/BAR. Some of the reasons for this litigation include: appeals of DCA/BAR administrative decisions, lawsuits filed against DCA/BAR attempting to prevent it from either properly investigating cases against licensees or challenging its authority to discipline licensees, and litigation against exhaust gas analyzer manufacturers for failing to meet DCA/BAR specifications. During FY 2000/2001, the amount of AG time devoted to civil litigation on behalf of the DCA/BAR totaled 8,543 hours and 10,497.5 hours in FY 2001/2002. Similar estimates for FY 2002/2003, when available, are expected to increase dramatically due to several very high profile cases.

Diverting Deputy Attorneys General to civil litigation on behalf of the DCA/BAR diminishes the number of Deputies and/or time that they can otherwise devote to the administrative prosecution of DCA/BAR cases. Despite the diversion of AG resources to these other areas of legal representation, the cost of engaging the AG's office for representation, as compared with the average cost of engaging outside counsel to represent the DCA/BAR, remains a bargain<sup>5</sup>, particularly when factors such as the specialized knowledge needed to handle these often highly complex and technical cases effectively is considered.

The OAH, a quasi-judicial tribunal that hears administrative disputes, is the other State agency that completes the cycle of investigation (DCA/BAR), prosecution (AG) and adjudication (OAH). OAH currently retains 53 independent Administrative Law Judges (ALJs) to conduct hearings for over 100 State and 500 local government agencies. Therefore, DCA/BAR is only one of over 600 State and local government agencies utilizing the services of the OAH. Consequently, because of the large demand for the utilization of OAH's services by various government agencies, the adjudication process is continually backlogged. The impact this has on DCA/BAR cases is that it allows non-complying Smog Check stations and technicians to remain in business until such time as their right to due process is fulfilled. The delay in obtaining hearing dates from OAH is particularly acute in Southern California.

Table 4.11 shows the average number of days necessary to adjudicate Smog Check enforcement cases. The two major stages of this adjudication process are depicted. Listed first is the average number of days elapsed from the date a case is first referred to the Attorney General's office until the date an accusation is filed. There is currently a 7.5 month backlog of Smog Check cases at the AG's office, awaiting the drafting of an accusation. Listed second on Table 4.11 is the average number of days elapsed from the date an accusation is filed until a decision is rendered. This tracks the number of days it takes for OAH to conduct a hearing and render a decision in the matter. There is currently a 13.5 month backlog of cases at OAH. Collectively, this means that in FY 2002/2003, it took 21 months (almost two years) to fully adjudicate a Smog Check case following the completion of an investigation.

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<sup>5</sup> The average hourly cost for AG service billings for attorney representation is less than half the average cost of outside counsel. (\$105 compared to \$265.)

**Table 4.11: Days to Adjudicate Smog Check Enforcement Cases**

Result	Fiscal Year			
	1999/2000	2000/2001	2001/2002	2002/2003
Average Days to Accusation*	192	193	278	225
Average Days to Decision**	284	298	443	407

\* From completed investigation to formal charges being filed.

\*\* From formal charges filed to conclusion of disciplinary case.

During this evaluation period, the impact of the 2001 hiring freeze and the 2000/2001 and 2001/2002 budget bills has had a dramatic effect on DCA/BAR and its enforcement program. Not only was DCA/BAR unable to fill its vacancies, it permanently lost 28.1 positions, including 8.5 positions directly responsible for enforcement in FY 2000/2001. In FY 2001/2002, DCA/BAR lost another 20.8 positions, including 2.3 directly tied to enforcement. Finally, DCA/BAR lost 42.5 additional positions in FY 2002/2003, including 17 enforcement positions. In summary, since 2001, DCA/BAR has lost a total of 91.4 positions, including 27.8 enforcement positions. Despite the decrease in resources, long cycle times and backlogs, DCA/BAR and the AG’s office have managed to increase the amount of enforcement as shown in Table 4.12.

**Table 4.12: DCA/BAR Enforcement Program Statistics**

Result	Fiscal Year						
	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003
Smog Check Licensees with Accusations Filed	175	325	207	343	301	379	407
Smog Check Licensees with Citations Issued	513	510	647	333	675	1,220	1,302
Referrals to DA/CA for Criminal Action	77	72	57	62	64	54	74

Recommendation: Several approaches to cope with the statewide hiring freeze, the loss of a significant number of enforcement and prosecutorial positions, and the increased complexity of cases have been identified:

- Authorize additional funding to restore DCA/BAR enforcement positions as soon as the economy improves;
- Create a specialized prosecution unit within the Licensing Section of the AG’s office to focus on Smog Check program cases. This would likely require direction from the Legislature; and

- Give DCA/BAR the statutory authority to retain a panel of highly experienced Administrative Law Judges dedicated solely to conducting hearings associated with disciplinary actions taken by DCA/BAR. This would require a change in State law.

**Recommendation #5** – In order to improve the enforcement of Smog Check requirements and improve station performance, DCA/BAR should be authorized funding to restore enforcement positions; a specialized prosecution unit should be established within the AG’s office to focus on Smog Check program cases which would likely require direction from the Legislature; and DCA/BAR should be given the statutory authority to retain Administrative Law Judges dedicated solely to conducting hearings associated with disciplinary actions taken by DCA/BAR which would require a change in State law.

Consumer/Industry Impacts: These changes are intended to improve DCA/BAR’s enforcement of Smog Check program requirements. There should be no direct impacts on consumers and businesses that are lawfully abiding by the Smog Check requirements.

#### **4.6.5 Major Findings of Station Performance Analysis**

Staff evaluated several components of station performance: the performance of Test-Only stations compared to Test-and-Repair stations; the effectiveness of repairs regardless of station type; and the enforcement program as the mechanism to identify “poor” performing stations and take legal action. The three main findings are as follows:

- Test-Only stations rank among the best performing stations when compared to Test-and-Repair stations in terms of identifying polluting vehicles. Furthermore, greater emission reductions are achieved when a vehicle is directed to a Test-Only station rather than a Test-and-Repair station. These results support recent program changes that increased the fraction of vehicles directed to Test-Only for biennial inspections. The continued direction of the highest polluting vehicles to Test-Only stations is an effective method to obtain more emission reductions than would be realized at Test-and-Repair stations.
- Repairs are not being adequately performed regardless of the station type completing the final Smog Check inspection. Furthermore, marginal repairs lead to rapid deterioration followed by increased emission levels. DCA/BAR is planning to develop separate standards for the after-repair test. These standards would provide additional emission reductions and protect consumers by helping to ensure that emission defects are fully repaired.
- Additional resources are needed to streamline the current enforcement program. The program was severely impacted by the statewide hiring freeze since 2001, the loss of a significant number of enforcement and prosecutorial positions and the increased level in the complexity of cases. Better enforcement provides a mechanism to improve the performance of stations in both identifying polluting vehicles and repairing them.

#### 4.7 Inspection of Smoking Vehicles

Background: Smoking vehicles can have an effect on air quality because they emit significantly more particulate matter than properly tuned vehicles. Vehicles may smoke all the time or only during start-up or only during acceleration. Under the California Motor Vehicle Code (Sections 27153 and 27153.5), it is against the law to operate a vehicle that emits excessive smoke. The CHP can cite vehicles for excessive smoke and, if warranted, impose a fine. These fines range from \$100 to \$250, depending on the type of vehicle, for first time offenders.

In addition, ARB and a number of air districts have implemented smoking vehicle programs to reduce visible exhaust from vehicles. Under these programs, drivers who spot a vehicle emitting excessive amounts of exhaust smoke can call a toll free complaint hotline to report it. After receiving a complaint, ARB or district staff mails an advisory letter to the owner informing them that a complaint has been filed against their vehicle. The letter advises smoking vehicle owners that their vehicle was reported to be smoking and recommends they have it repaired. The letter also alerts the owners to the fact that operating excessively smoking vehicles is a violation of the State Motor Vehicle Code and that they are subject to fines if cited by the CHP. After owners make the necessary repairs, they are asked to complete the smoking vehicle compliance form attached to the advisory letter. On average, more than 40 percent of the vehicle owners who receive an advisory letter return their completed compliance forms, stating that they have attended to their vehicles, either having it checked and, if warranted, having any needed repairs made.

An inspection for excessive smoke is not part of the current Smog Check program. While some smoking, gasoline-fueled engines also have high gaseous emissions of HC, NO<sub>x</sub>, and/or CO, this is not always the case, and a smoking vehicle can pass the current Smog Check inspection. Thus, an opportunity to complement other smoke reduction programs and further reduce the number of smoking vehicles is being missed.

Evaluation: Smoking vehicles are more than just a nuisance; they are a public health problem. Based on laboratory tests, smoking vehicles have particulate emission rates averaging 0.27 g/mi during normal operation. In contrast, vehicles in a proper state of repair have particulate emission rates at least 90 percent lower. Excess particulate emissions from smoking vehicles may be as much as 1.6 tpd based on an estimate that there are 200,000 smoking gasoline fueled light-duty vehicles currently driving 30 miles per day. These emissions can cause premature death.

Adding a smoke inspection component to the Smog Check program would provide an additional mechanism to ensure more effective enforcement of the State law prohibiting operation of smoking vehicles, complementing current enforcement mechanisms such as CHP citations and ARB/district complaint lines. The repair of smoking vehicles would reduce visible smoke and particulate emissions.

Recommendation: Incorporate an inspection for smoking vehicles during the Smog Check test. This would help reduce the number of smoking vehicles and would reduce particulate emissions and their associated health effects.

**Recommendation #6** – Provide authority to include a smoke test of vehicles as part of the Smog Check inspection. This would require a change in State law.

Consumer/Industry Impacts: Adding a smoke inspection to the Smog Check program may add a minute or two to the current Smog Check inspection. Other than that additional time, most consumers would be unaffected by this change because it is estimated that only a small fraction of the fleet (about 200,000 vehicles) emit excessive smoke. Consumers whose vehicles are identified as smoking would incur additional repair costs. However, this would not be a new burden on consumers since State law already prohibits the operation of excessively smoking vehicles. This change would simply provide an additional mechanism to enforce the existing statute. Because excessive smoke is an indicator of an engine problem, consumers whose vehicles are repaired would reap the benefit of a better performing vehicle.

The Smog Check industry could incur some initial costs in training technicians to perform smoke inspections. Some test equipment may need to be purchased by stations, causing the inspection fee to be minimally increased as stations pass the cost along to consumers. Additional repair revenue would potentially be generated for the Smog Check repair industry from repairing smoking vehicles.

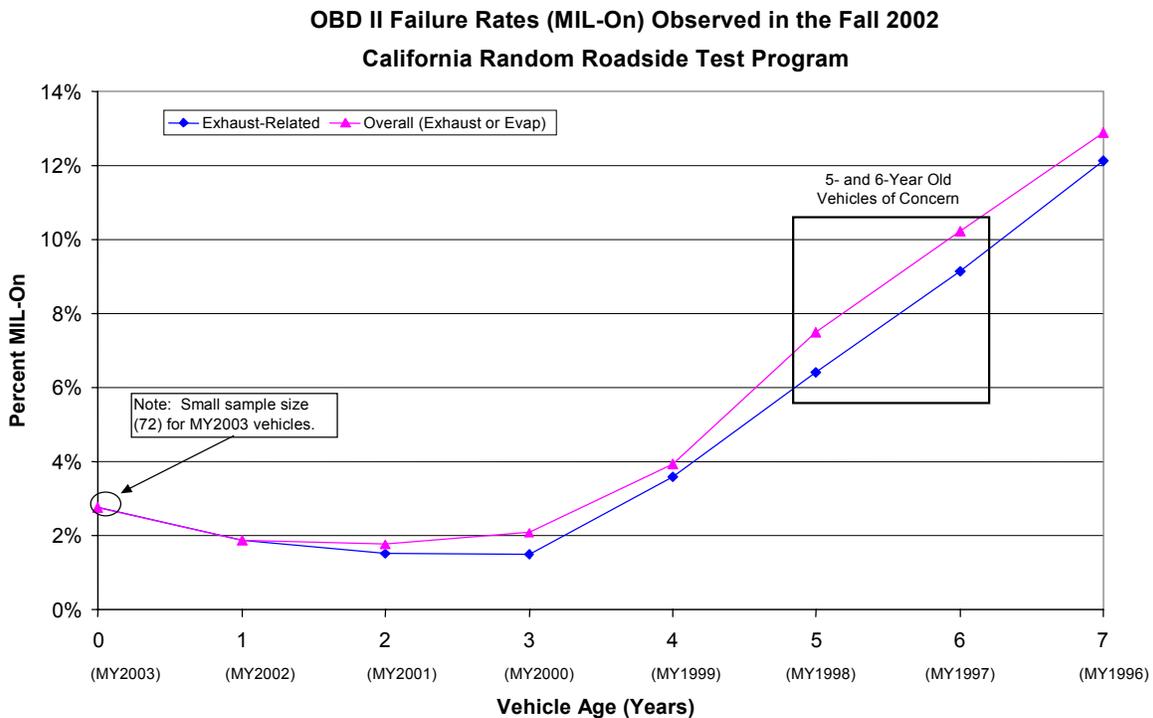
#### **4.8 Model Year Exceptions from the Change of Ownership Inspection**

Background: Since the early 1970s, vehicles have been required to obtain Smog Check inspections upon change of ownership. The exception for newer model year vehicles subject to the biennial Smog Check program does not apply to the change of ownership inspection requirement. The Smog Check requirement for vehicles that change ownership is a consumer protection mechanism as well as an emission reduction measure. It ensures that consumers are purchasing used vehicles with intact emission control components. However, improvements in vehicle emission control and engine management technology over the years have reduced the incidence of tampering, especially on newer model year vehicles. As a result, staff examined the impact of excepting newer model year vehicles that are two years old or less from the Smog Check inspection requirement upon change of ownership. Vehicles that are two years old or less are sufficiently under the emission control warranty time period, thereby offering a consumer protection component.

Evaluation: Smog Check station data from Spring 2003 shows a minimal overall failure rate (2.6 percent) and a negligible tamper rate (less than 0.05 percent) for vehicles that are two years old or less. The negligible tamper rate of less than five vehicles out of every 10,000 suggests that there is no longer a need to inspect these newer vehicles to protect consumers from purchasing vehicles that have been tampered with. Of the vehicles that do fail, the majority are OBD II-related failures and the owners are expected to respond to the malfunction indicator light (MIL) by seeking repairs at the dealership, which would be covered under the vehicle's warranty. Thus, the emission impact of excepting these vehicles from change of ownership testing is expected to be negligible.

In a separate analysis, OBD II failure rates for 1996 and newer vehicles were estimated from data collected during a special DCA/BAR roadside study in Fall 2002. These failure rates were used to estimate initial test failure rates in the analysis performed to evaluate the impact of exempting five and six year old vehicles (described in Section 3.3). Figure 4.5 shows the OBD II failure rates (i.e., MIL is on) for the five and six year old vehicles as well as vehicles that are four years old and newer. The figure illustrates that MIL-on rates increase substantially after three years of age (1999 and older vehicles). This effect most likely is related to the expiration of the typical three-year “bumper to bumper” warranty. (Please note that the upturn in failures for 2003 model year vehicles in Figure 4.5 is most likely an artifact of the extremely small sample size – two failures in 72 vehicles tested – rather than an indication that these vehicles are actually failing at a higher rate than 2000-2002 model year vehicles.)

**Figure 4.5**



Based on data from the DCA/BAR Executive Summary report, approximately 330,000 vehicles two years old or less statewide received a change of ownership inspection in calendar year 2002.

Recommendation: Except from the change of ownership Smog Check requirement vehicles purchased from new or used car dealers that are two years old or less and are still under full warranty. Since these vehicles are still under warranty, this change would continue to offer consumer protection as well as the consumer convenience realized by the exception. This would require a change in State law.

**Recommendation #7** – Vehicles two years old or less that are still under full warranty should be excepted from the change of ownership Smog Check requirement. This would require a change in State law.

Consumer/Industry Impacts: This change would affect the estimated 330,000 consumers per year who sell their two year old or newer cars that are still under warranty. These consumers would save both time and the \$46 cost (on average) of a Smog Check inspection, resulting in an overall savings of \$15 million for California consumers. Smog Check stations would forego an estimated \$15 million in testing revenue.

#### **4.9 Evaluation of Other Potential Changes to the Smog Check Program**

Staff examined several other potential program elements that could provide additional emission reductions and/or make the program more convenient for motorists. These include adding motorcycles and diesel-fueled vehicles (passenger, light-duty trucks and medium-duty trucks) to the program, improving compliance with vehicle registration requirements, and restarting the vehicle retirement program. Initial evaluation suggests that these improvements may have merit. However, additional studies are needed before recommendations for program changes could be made.

**Inclusion of Motorcycles:** The number of motorcycles registered in the State is approximately 400,000. These gasoline-powered vehicles emit the same pollutants as vehicles tested in the current Smog Check program, at higher rates. Evaporative emissions are a major problem as the sun shines directly on the fuel tank, heating the tank, readily releasing hydrocarbons into the environment during refueling. Due to their low annual mileage accumulation, motorcycles do not exhibit significant deterioration of emission control systems. However, motorcycles are subject to high rates of exhaust system tampering. Based on surveys by the Motorcycle Industry Council, 34 percent of on-road motorcycles have been retrofitted with aftermarket exhausts that eliminate the catalytic converter on catalyst-equipped motorcycles. The high rate of tampering will become increasingly significant from an emissions control perspective, as more motorcycles are factory-equipped with catalytic converters to meet more stringent, new vehicle emissions standards that have been adopted for model years 2004 and 2008. It is therefore becoming more important to consider including motorcycles in the program.

Before recommending adding motorcycles to the Smog Check program, additional study is needed regarding how this change would be implemented. For example, if the main concern is tampering with the emission control system, it might be appropriate to require only a visual inspection to verify that emission control components are intact instead of a full emissions test. After further investigation of appropriate tests for motorcycles in a Smog Check program, staff would evaluate potential emission reduction benefits, ease of implementation, impacts on motorists, and cost-effectiveness.

**Inclusion of Diesel Vehicles:** In California, there are over 200,000 diesel-fueled vehicles that are passenger cars, light duty-trucks or medium duty-trucks. Although diesel vehicles tend to have low HC emissions, these vehicles emit higher levels of NOx and

particulate matter than similar sized gasoline vehicles. Diesel-fueled vehicles are not currently part of the Smog Check program. As a result, the public may perceive that there is an inequity in the treatment of gasoline and diesel vehicles. In 1991, ARB conducted a preliminary evaluation of the potential for an I/M program for diesel cars. At that time, it was found repairing vehicles to reduce NOx emissions led to an increase in HC emissions, so there was no significant net NOx plus HC reductions, and it was found that repairs were not cost effective. However, it may be appropriate to reevaluate whether diesel vehicles should be added to California's enhanced Smog Check program. In order to consider whether a cost effective Smog Check program for diesel vehicles is feasible, staff would need to evaluate whether a test could be designed to identify excess emissions including particulate matter, whether repairs could be made to reduce those excess emissions, and whether a significant fraction of the fleet has excess emissions.

**Improving Vehicle Registration Compliance:** In ARB's August 17, 2000 letter to U.S. EPA on improving the Smog Check program, addressing administrative loopholes associated with the vehicle registration process was identified as a potential program improvement since the Smog Check inspection requirement is directly tied to vehicle registration. DCA/BAR recently began evaluating the vehicle registration process to determine if vehicles that should be subject to biennial Smog Check inspection are correctly identified and notified of the requirement, and that any certificates, exceptions, or exemptions granted as proof of compliance are legitimate.

In addition to identifying the administrative loopholes, a survey conducted for ARB by the College of Engineering-Center for Environmental Research and Technology (C-CERT) found an instantaneous unregistered rate of 3.4 percent in California. The survey also found that the unregistered rate diminishes after three months to less than one percent two years later.

Further examination is necessary to determine the potential emission reduction losses associated with non-compliance with registration requirements, necessary programmatic changes, impact on motorists, and cost effectiveness, including any potential loss of State revenue resulting from delayed vehicle registration compliance or administrative loopholes.

**Restart Vehicle Retirement Program:** DCA/BAR operates a Consumer Assistance Program (CAP) which offers motorists financial assistance to repair or retire vehicles that fail Smog Check. Income eligible motorists can qualify, as well as those individuals whose vehicles require inspection at a Test-Only station. Both the repair and retirement elements of the CAP have been successful, although the data suggests that the vehicle retirement element, which was suspended in January 2002 due to budget constraints, results in greater emission reductions for each dollar expended. Program data show:

- Between July 1, 2000 and June 30, 2003, DCA/BAR assisted in the repair of 60,636 vehicles (of which 26,118 or 43 percent failed Smog Check at "gross polluter" levels), at a total disbursement cost of over \$21 million. These repairs

resulted in an estimated 1.6 tpd of cumulative<sup>6</sup> HC and NOx emission reductions in FY 2002/2003.

- Between July 1, 2000 and December 31, 2001, DCA/BAR retired 34,003 vehicles (of which 23,648 or 69 percent failed Smog Check at “gross polluter” levels), at a total disbursement cost of about \$38 million. Retiring these vehicles resulted in an estimated 4.1 tpd of cumulative<sup>7</sup> HC and NOx emission reductions in FY 2002/2003.

After completing a competitive bid to buy and retire high-polluting vehicles, DCA/BAR plans to restart a vehicle retirement program in Spring 2004.

#### **4.10 Potential Future Opportunities to Redesign Program**

Two technologies, OBD II and remote sensing offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience of Smog Check. Both are the subject of studies designed to determine how best to use these technologies in the enhanced Smog Check program. These studies are underway, and results will be available in approximately one year. The technologies, and how they might be used in the Smog Check program, are discussed below. Once these studies are complete, staff will report and recommend further program design changes, if appropriate.

##### OBD II

OBD II is a diagnostic system installed on all new cars sold since the 1996 model year. The vehicle’s computer continuously performs a diagnostic check of every emissions control system on the vehicle. For major systems such as the catalytic converter, evaporative, ignition, and fuel systems, the computer determines the performance of the system and evaluates whether emissions have increased beyond a threshold value (e.g., a 75 percent increase above normal levels). For the dozens of other sensors on the vehicle, the computer determines if the part is functioning and providing a reasonable value. All this information is available to the technician to help repair the vehicle.

Current Smog Check inspections include an automated evaluation of the OBD II system, using the test analyzer connected to the vehicle’s computer. This is in addition to a test of the vehicle’s emissions while driven on a dynamometer. The purpose of the study underway is to determine if the OBD II system is as effective in identifying vehicles with high emissions as the current emissions test. If the efficacy of OBD II were demonstrated, it would be possible to drop the dynamometer test for 1996 and newer cars. This would reduce the time to complete the test and lower its cost.

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<sup>6</sup> Emission reductions achieved by the repair assistance program are assumed to last for two years, until the next biennial inspection.

<sup>7</sup> Emission reductions achieved by the vehicle retirement program are assumed to last for three years, the average number of years the vehicle would have continued operating if it had not participated in the voluntary retirement program.

It may also be possible to use OBD II with modern electronic systems to increase the convenience for the motorist. For example, it may be possible to provide ATM-like devices where a motorist could hook up his car and have the Smog Check performed automatically. This concept is similar to the automated checkout now being used at some grocery and home improvement stores.

If the efficacy of OBD II as the sole inspection mechanism is determined, staff will report on opportunities to use it to improve the Smog Check program.

### Remote Sensing

The second technology being evaluated is remote sensing. The RSD shoots a beam of infrared and ultraviolet light across the path of a moving vehicle and determines its tailpipe emissions. Limitations in using the device prevent it from being used to replace the current Smog Check emission test. However it may be possible to use RSD to improve the effectiveness and reduce the cost of Smog Check.

DCA/BAR and ARB are currently conducting a joint study to determine how best to use RSD in Smog Check. The results of the pilot study will be used to design an on-going RSD program. One question being evaluated in the study is whether RSD can be used to “clean screen” a vehicle and thus exempt it from its next biennial test. If RSD can identify vehicles with low emissions, costs would be reduced and consumer convenience improved. However, if the RSD incorrectly identifies a high emitting vehicle as clean, emission reductions would be lost. The study will quantify RSD’s effectiveness and provide a technical basis for deciding its use.

RSD may also be effective in identifying gross emitting vehicles. For example, it could be used to identify gross emitters between biennial inspections and require their repair. It could also be used to randomly inspect vehicles older than 30 years that are exempt from biennial inspections. In both cases, emission reductions from the Smog Check program could be increased. The study will determine if RSD is accurate enough to be used to call in suspected gross emitters for an inspection at a Smog Check station.

## 5 Summary and Recommendations

Enhanced Smog Check is one of the most important emission reduction programs in California, alone providing 106 tpd HC and 76 tpd NO<sub>x</sub> reductions beyond the basic Smog Check program in 2002, as shown in Table 3.3. The cost effectiveness of the I/M program for the enhanced areas in California is estimated to be about \$5,300 per ton of HC and NO<sub>x</sub> reduced. This cost effectiveness compares favorably to the typical cost effectiveness values for recently adopted ozone control measures of about \$10,000 per ton. In addition, DCA/BAR has implemented several program improvements since 2001 that will provide additional emission reductions beyond those being achieved in 2002. With the additional HC and NO<sub>x</sub> emission reductions needed to meet the State and federal air quality standards, it is critical that California continue to achieve all the emission reductions feasible from the Smog Check program.

Within this context, DCA/BAR and ARB have evaluated the need for a comprehensive redesign of the program as directed in statute and have also evaluated improvements within the framework of the current program design. Staff has concluded that the current Smog Check program is working by delivering cost-effective emission reductions. However, there are opportunities to improve the program. Based on the program evaluation, the following potential improvements to the current program, within the framework of the current program design, have been identified:

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions through other means. DCA/BAR has existing authority to except these vehicles from the biennial inspection, but a change in State law would be required to authorize DCA/BAR to collect a fee from any excepted vehicles and to use those fees toward programs that would offset the foregone emission reductions.
- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles. This would require a change in State law.
- Inspecting older vehicles annually. This would require a change in State law.
- Inspecting high mileage vehicles annually. This would require a change in State law.
- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired.
- Improving the enforcement of Smog Check program requirements by:
  - Authorizing funding to restore enforcement positions at DCA/BAR;
  - Establishing a specialized prosecution unit within the Attorney General's office to focus on Smog Check program cases (which would likely require direction from the Legislature); and

- Granting statutory authority for DCA/BAR to retain Administrative Law Judges dedicated solely to conducting hearings associated with Smog Check disciplinary actions (which would require a change in State law).
- Adding a smoke test to the Smog Check inspection to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles. This would require a change in State law.
- Excepting newer cars (two years old or less that are still under full warranty) from the requirement for a Smog Check upon change of ownership. This would require a change in State law.

In addition, there are promising technologies such as on-board diagnostics (OBD II) and remote sensing that may offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience. Both technologies are the subject of studies designed to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, DCA/BAR and ARB will report and recommend further program design changes.