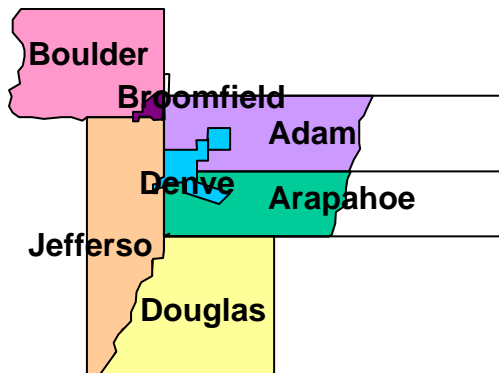
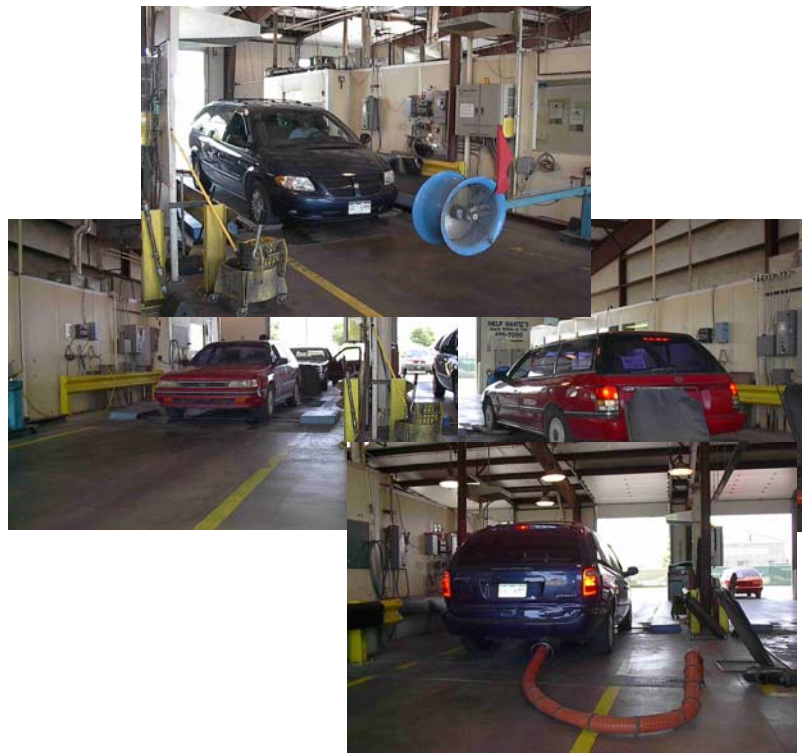


*2007 Annual Report  
On the  
Automobile Inspection and Readjustment  
Program*



*July 1, 2008*



# **Annual AIR Program Report**

## **Executive Summary**

The Denver Metropolitan area maintains an automotive emissions inspection program whose purpose is to detect, and cause to be repaired, excessively emitting vehicles. Vehicles that fail the emissions test must pass a subsequent retest in order to operate within the program area, unless they qualify for a waiver. Repair of these high emitting vehicles result in lower vehicle emissions and contributes to improvement in the metro area's air quality.

### **AIR Program**

Currently the Automobile Inspection and Readjustment (AIR) Program consists of an "enhanced" Inspection Maintenance (IM) Program that utilizes a dynamometer-based IM240 test for 1982 and newer light-duty vehicles and a two-speed idle test for 1981 and older light-duty vehicles. A visual test and gas cap check are also conducted. The program is registration enforced.

### **IM Network**

For calendar year 2007 there were 14 Air Care Colorado centers with 75 inspection lanes located throughout the seven-county Denver metropolitan area. These centralized facilities can inspect all vehicles. There were also six independent test-only stations that test 1981 and older vehicles. In addition to these facilities there were 24 stations for testing qualifying commercial and governmental fleets.

### **Program Results**

During 2007, approximately 906,000 initial emissions inspections were performed. Approximately 742,000 were IM240 inspections, 73,000 were two-speed idle tests, and 91,000 were clean screened using remote sensing. Approximately 484,000 vehicles in the fleet were exempted from inspection due to the new vehicle exemption for the first four model years. Vehicles in the enhanced program had a failure rate of 5.8% for the IM240 inspection test procedure and 11.4% for the idle test procedure.

The net cost of the total program during 2007 was estimated to be approximately \$29 million.

For ozone precursors the Air Pollution Control Division estimates the cost effectiveness of the inspection program at \$7,071 per ton removed. For wintertime carbon monoxide (CO) the cost effectiveness is estimated at \$513 per ton.

To increase motorist convenience, a clean-screen program was in operation within the Denver program area called RapidScreen. This program uses remote sensing device

(RSD) systems to measure tailpipe emissions while a vehicle is operating on the road. Those vehicles meeting the clean screen criteria are then exempted from the next regularly scheduled emissions test. By the end of 2007 there were a total of 18 RSD units operating within the DMA resulting in approximately 140,000 unique vehicles observed. From the observed vehicles roughly 109,000 were determined clean.

In 2006, HB 06-1302 was passed directing the Colorado Department of Public Health and Environment (CDPHE) to develop an RSD-based high-emitter program. This program uses the same RSD infrastructure as the clean-screen program, however, high emitting vehicles are targeted instead of low emitting ones. Development work for this project was conducted in 2007 and a pilot high-emitter program began in December 2007.

A low-emitter index (LEI) was developed and implemented in 2007 which uses historical IM240 test data to develop a failure probability based on a vehicle's year, make, model, and engine size. Previously, a vehicle needed at least two clean observations within the preceding twelve months for the exemption. However, if a vehicle has a low probability of failing an IM240 test then only one observation is needed for the exemption.

The Division continues to operate a smoking vehicle hotline allowing motorists to report vehicles observed while driving that smoke. Once reported, the Division provides owners of the vehicles with information that will encourage them to voluntarily make needed repairs. Beginning in 2007, vehicle information reported on the hotline is transferred to the IM240 lane inspectors alerting them that the vehicle they are inspecting has been reported as a smoking vehicle. If the vehicle is smoking at the time of the inspection it fails the emissions test.

# **Annual AIR Program Report**

## **Introduction**

The Denver Metropolitan area maintains an automotive emissions inspection program whose purpose is to detect, and cause to be repaired, excessively emitting vehicles. Vehicles that fail the emissions test must pass a subsequent retest in order to operate within the program area, unless they qualify for a waiver. Repair of these high emitting vehicles result in lower vehicle emissions and contributes to improvement in the metro area's air quality.

## **AIR Program**

The Automobile Inspection and Readjustment (AIR) Program has been in operation within the Denver Metropolitan Area (DMA) since July 1, 1981. Originally, the program consisted of the six DMA counties (Boulder, Denver, Douglas, Jefferson, and western Adams and Arapahoe) plus parts of El Paso and Larimer counties. The metropolitan Greeley area in Weld County was included in January 1988.

Starting January 1, 1995, the current enhanced IM Program was established in the Denver metropolitan area, with a basic program in the outlying Front Range areas. Changes to the emissions program since that time, have resulted in the basic program in Larimer, El Paso, and Weld counties being discontinued, as of January 1, 2007. This action was based on those area's long-term compliance with the National Ambient Air Quality Standards for carbon monoxide (CO), and adoption of revised CO State Implementation Plans (SIPs).

However during the summer of 2007, the Denver-metropolitan and North Front Range areas violated the 8-hour federal ozone standard, based on monitored ozone concentrations from 2005-2007. Because of this, on November 20, 2007 the US EPA designated these areas as being in nonattainment of the National Ambient Air Quality Standards. Currently, the North Front Range area is considering the readoption of an IM program in Larimer and Weld counties because of this violation.

## **Enhanced IM Program**

Currently the Automobile Inspection and Readjustment (AIR) Program consists of an "enhanced" Inspection Maintenance (IM) Program that utilizes a dynamometer-based IM240 test for 1982 and newer light-duty vehicles and a two-speed idle test for 1981 and older light-duty vehicles. Heavy-duty and oversized vehicles, as well as certain vehicles that cannot be inspected on a dynamometer are inspected using the two-speed idle tests.

All vehicles 1975 and newer receive a visual emissions control system inspection that includes the catalytic converter, air injection system, oxygen sensor(s), and fuel inlet restrictor. Light duty gas vehicles 1975 and newer also receive a gas cap pressure test. If a vehicle fails one or more of these inspections the vehicle fails the overall IM test. The IM program is registration enforced.

All 1982 and newer vehicles undergo a two-year emissions inspection cycle, with 1981 and older vehicles on a one-year inspection cycle. New vehicles are exempt from IM inspection for the first four years.

### **Clean Screen Program**

To improve motorist convenience, the State administers a remote sensing clean screen program in the Denver metropolitan area. Remote sensing is a method for monitoring vehicle emissions while simultaneously photographing the license plate when a vehicle passes through infrared and ultraviolet beams of light. Owners of vehicles meeting the clean screen criteria are notified by the County Clerk that their vehicle have passed the inspection process, and are exempt from their next regularly scheduled IM 240 emissions test.

Legislation (HB06-1302) passed in 2006 mandated a high-emitter identification program in the Denver metropolitan area. A plan implementing the remote sensing based program was presented to the Air Quality Control Commission in December 2006.

In October 2007, the Air Quality Control Commission promulgated regulations for the implementation of a the high emitter identification program on a limited pilot scale basis. The Division began implementing the pilot program in December 2007, and will continue to operate the program throughout 2008. The Division will periodically update the Commission on the progress of the program and provide data to be used in evaluating the effectiveness of remote sensing in identifying high emitting vehicles.

### **OBD – MIL Inspection**

Essentially all light-duty gasoline vehicles produced for sale in the US since the 1996 model year have a special software and hardware package installed called On-Board Diagnostics - Generation II or OBD II. This system incorporates special devices, statistical models, and procedures to *predict* (as opposed to measure) the vehicle's emissions. Once the system identifies a problem, a special light on the instrument panel is turned on and a fault code is stored in the vehicle computer's memory indicating the likely problem area.

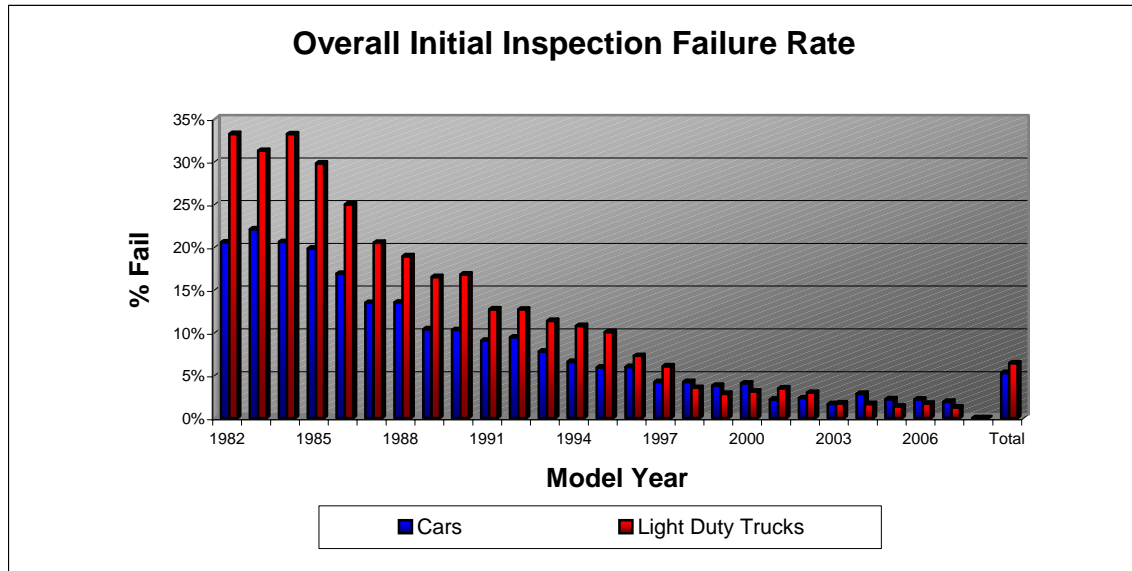
On-board-diagnostic and illuminated malfunction indicator lamp checks have been required in Colorado for 1981 and newer vehicles. The inspection procedure for these vehicles includes a visual check to ensure that the overall system integrity is intact. In October of 2002, the Commission made these inspections advisory-only checks.

# IM240 Test Results

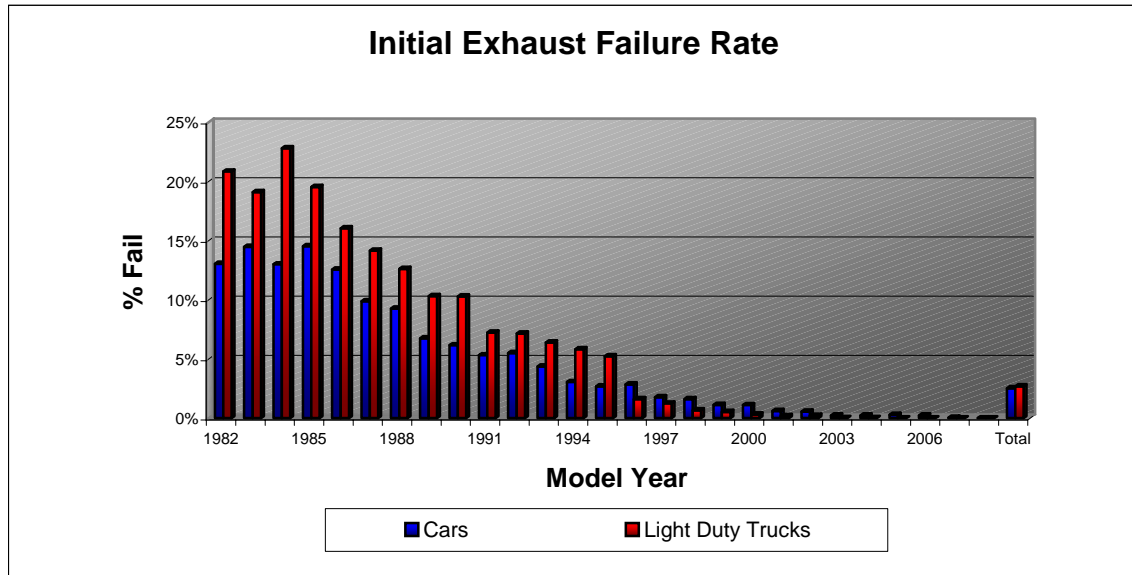
## Overall/Exhaust Results

During 2007 there were a total of 741,915 initial IM240 inspections performed. Of these, 43,040 vehicles failed, resulting in an overall initial failure rate of 5.8%. Of these, a total of 19,315 failed for excess exhaust emissions. Figures 1 and 2 show the IM240 program's overall failure rates and exhaust fail rates respectively for all 1982 and newer vehicles. The highest failure rates were for the 1982 to 1986 model years. For this group of vehicles, model year failure rates ranged from 27% to 20%. The failure rate for the newest of the model years was very low at 2% or less

Figure 1



**Figure 2**



Vehicles that failed their initial IM240 test (43,040) emitted an average of 2.4, 28.6, and 1.7 grams per mile of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) respectively. Table 1 below shows the average emissions from the vehicles that failed their initial IM240, passed a subsequent retest and percent reduction by pollutant and vehicle type.

**Table 1**

	Failed Initial Inspection			Passed Retest			Percent Reduction		
	HCgpm	COgpm	NOxgpm	HCgpm	COgpm	NOxgpm	HC	CO	NOx
Cars	2.11	26.08	1.44	.66	6.49	1.14	68.7%	75.1%	20.8%
Trucks	2.61	31.19	1.90	1.14	11.10	2.06	56.3%	64.4%	-8.4%
<b>Total</b>	<b>2.36</b>	<b>28.63</b>	<b>1.67</b>	<b>.90</b>	<b>8.83</b>	<b>1.61</b>	<b>61.9%</b>	<b>69.2%</b>	<b>3.6%</b>

Figure 3 through 5 compares the average initial test emissions for HC, CO, and NOx for passing vehicles and failing vehicles by model year.



Figure 3

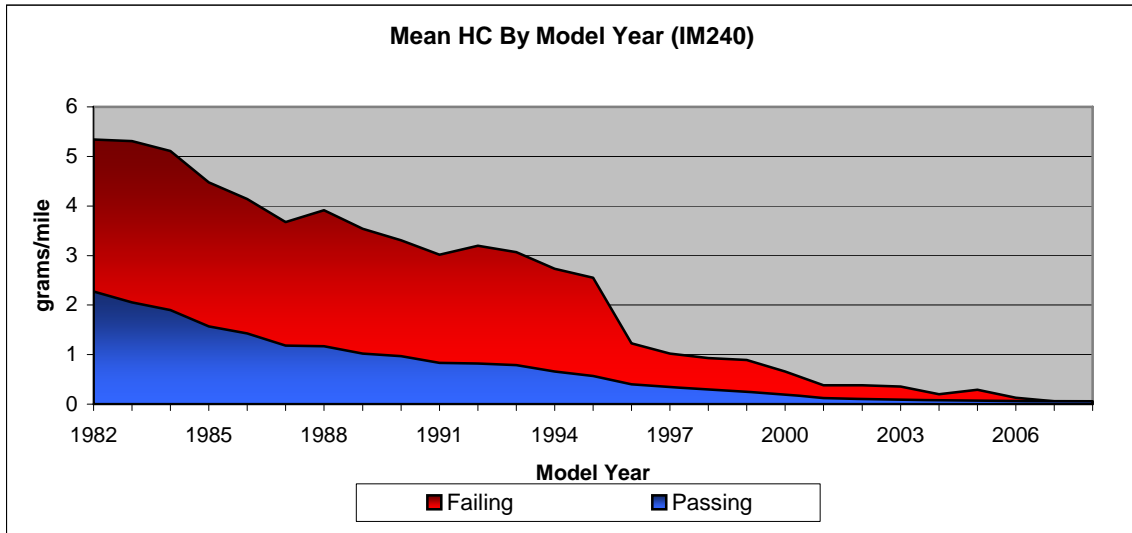


Figure 4

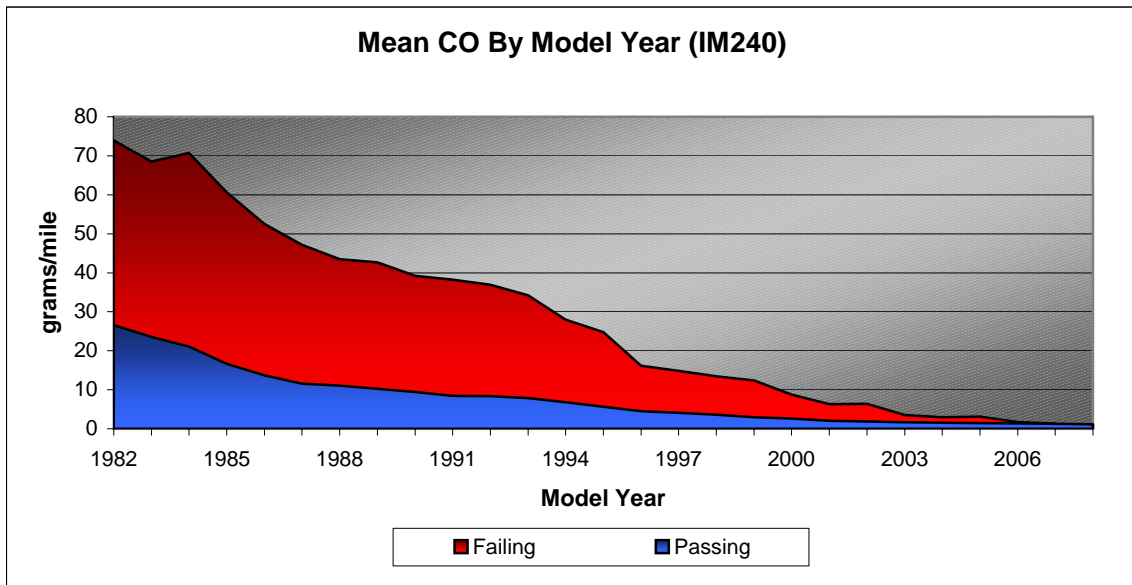
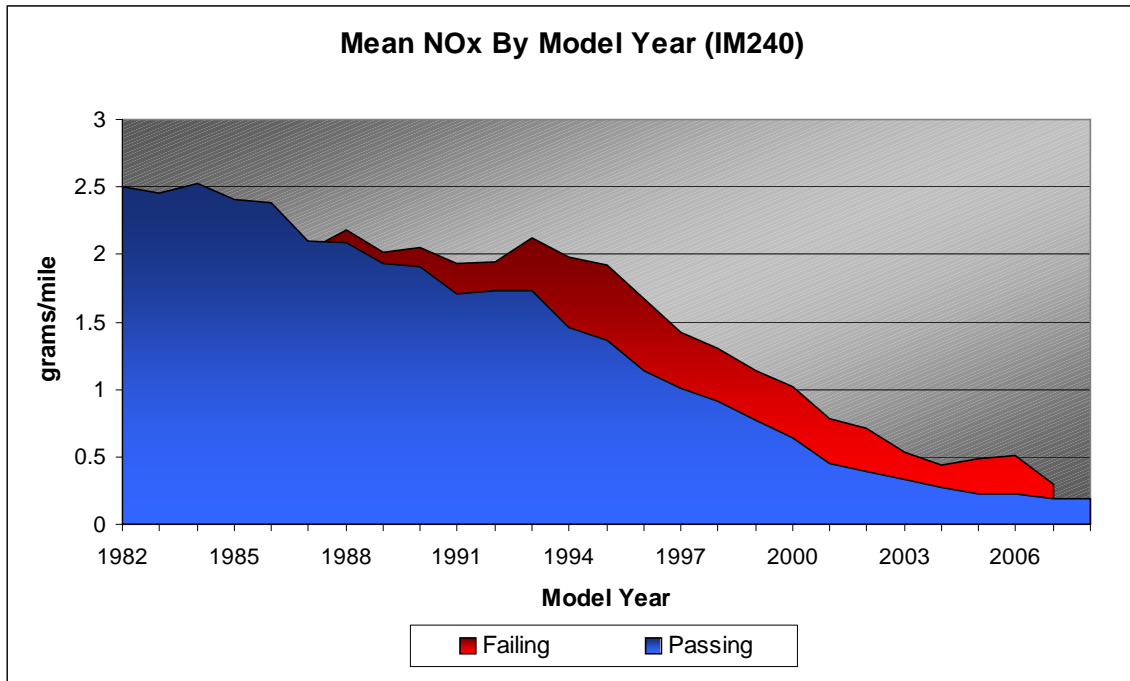


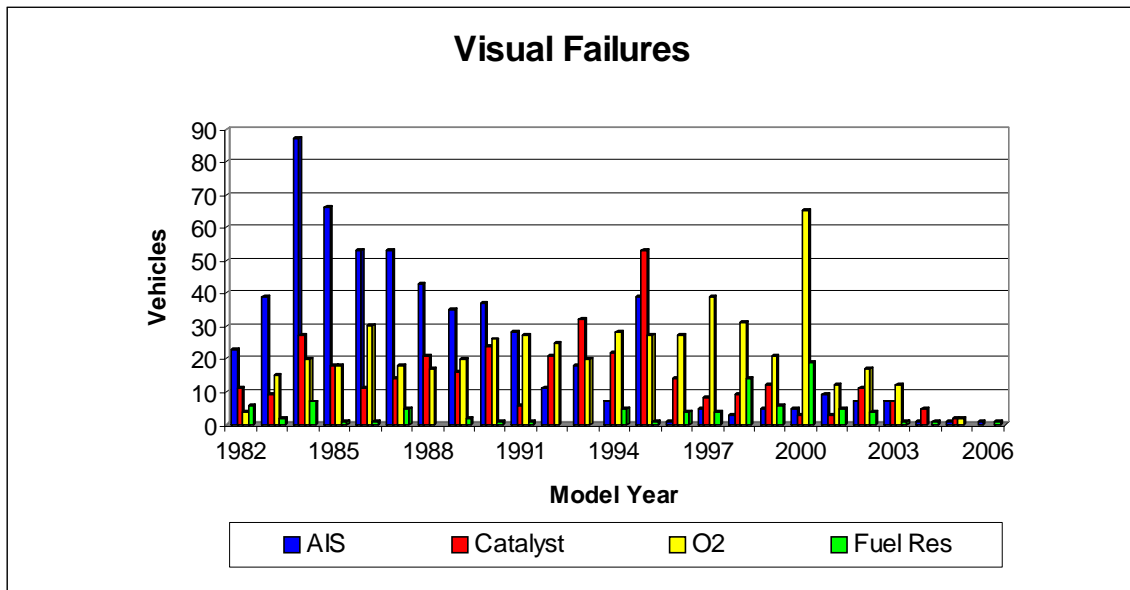
Figure 5



### Visual Inspection Results

Vehicles also fail for a visual inspection of the secondary air injection system (AIS), catalyst, oxygen sensor, and fuel inlet restrictor. Figure 6 shows the number of vehicles failed by component and model year.

Figure 6



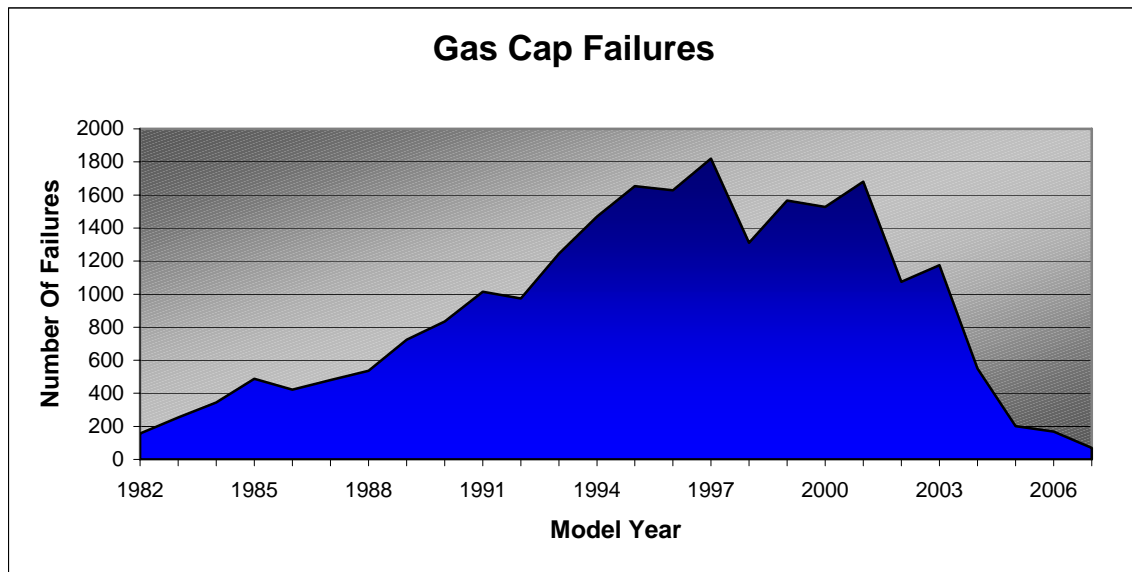
## Gas Cap Inspection Results

Another component of the inspection program is a functional test of the vehicle's gas cap. The cap is installed on a device that pressurizes the cap and measures the decay of that pressure over time. If the pressure decay exceeds the standard the cap fails the test and motorists are required to install a functional cap.

The benefit of this test is the reduction of unrestricted gasoline vapor venting to the atmosphere; a major factor in ground-level ozone formation. There is uncertainty in quantifying the benefit of this part of the program because of the complex way that fuel vapor pressure, temperature, leak size and shape, and other variables interact with each other. However, the MOBILE 6.2 emissions model estimates the gas cap program removes approximately 1.8 tons of hydrocarbons per day.

Figure 4 shows the number of gas cap pressure failures by model year.

Figure 7



## Retests

In 2007 8,636 vehicles failed their first IM240 retest. For additional information on retest activity see "Retest Frequency Report" in Appendix E.

## Waivers

Section 42-4-306(9)(b), C.R.S. requires a determination of the number of motor vehicles that fail to meet the applicable emission standards after the required repairs are made. In 2007, 159 waiver applications were approved by the Department of Revenue. An additional 19 hardship waivers were issued to vehicle owners as a result of an economic hardship qualified by documented public assistance or welfare.

## Unresolved Vehicles

Approximately 18% of failing vehicles in 2007 did not receive a passing retest. These unresolved vehicles are sometimes called “disappearing” vehicles. In May 2007, CDPHE queried the RSD database to look for 7,356 unresolved vehicles from the 2006 inspection year. An issue in this analysis is determining exactly when an RSD-observed vehicle becomes “unresolved.” An example would be a vehicle that fails on January 1, and is then observed by RSD on January 2 would not be considered unresolved. To minimize this issue, the results of the following analysis are provided as a date difference in 30, 60, 90, 120, and 180-day positive increments between the last failing I/M test and the last RSD observation.

Of the 7,356 unresolved vehicles, 1,409 (approximately 19%) were observed by RSD at some point between January 1, 2006 and April 30, 2007. However, most of these observations took place before the vehicle failed their IM240 test. After filtering for only those vehicles that had RSD observations *after* failing the I/M test, the vehicle count dropped to 259. As observed, as the number of days between the failing I/M test and RSD observation are increased, the number of vehicles observed by RSD drops. The following table illustrates this change:

Positive Date Difference Between Last I/M Test and Last RSD Record	Number of Vehicles
+30	203
+60	160
+90	127
+120	101
+180	56

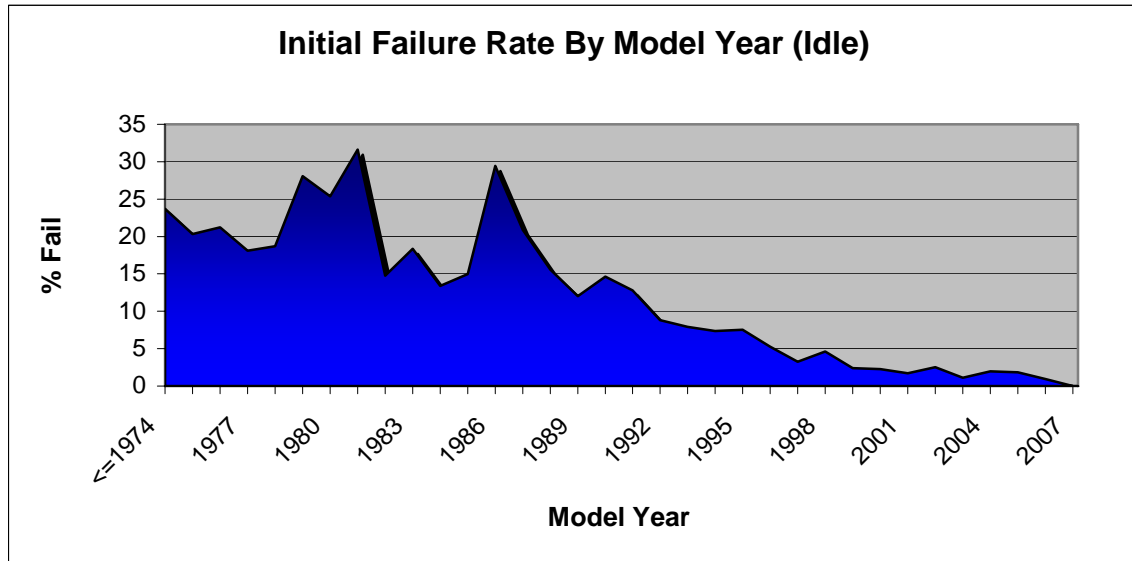
Unresolved vehicles operating within the I/M area continue to be an issue. However, the above figure suggests that the number of the unresolved vehicles still operating within the I/M area is relatively low.

## Idle Test Results

### Failures

In 2007 72,763 vehicles underwent the two-speed idle test within the enhanced program area. Of these, 8,285 failed their initial test, resulting in a failure rate of 11.4%. There were 6,484 vehicles that failed the exhaust portion. Figure 8 shows the failure rate percentage by model year.

Figure 8



Figures 9 and 10 compares the average initial test emissions for HC and CO for passing and failing vehicles. NO<sub>x</sub> emissions are not measured as part of the idle test protocol.

Figure 9

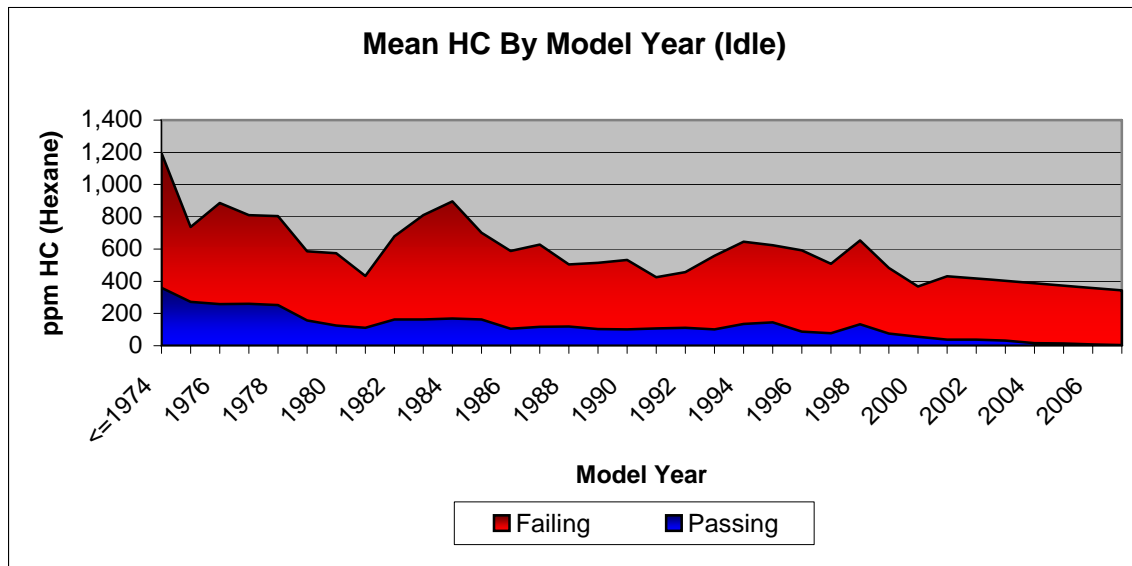
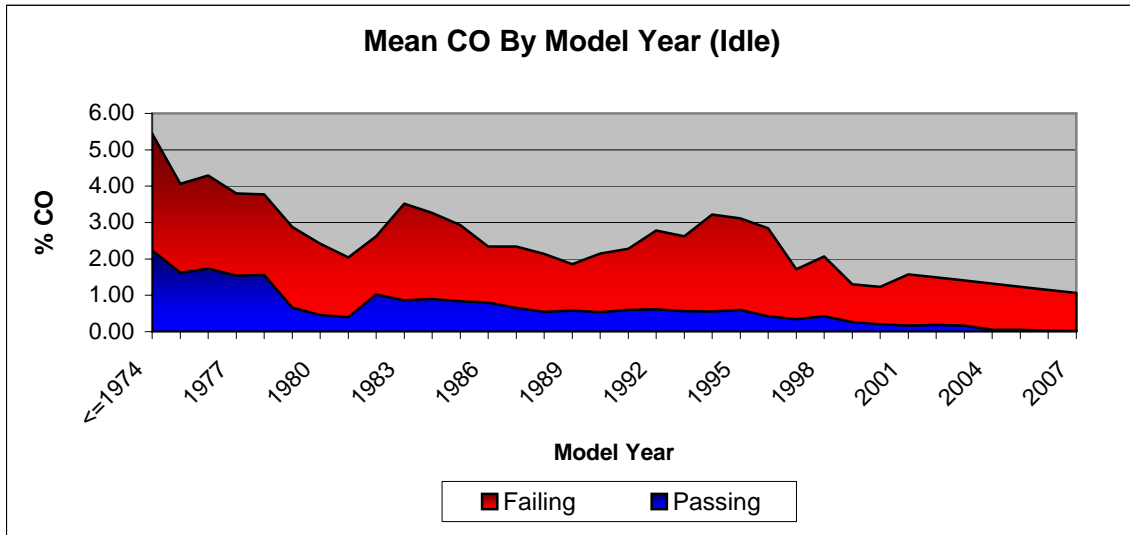


Figure 10



### Visual Failures

For idle testing, 1,287 failed for the visual inspection only, and 514 failed for both visual and exhaust.

## On-Board Diagnostic Inspections

### OBD Results

Colorado includes a scan of the on-board computer for properly equipped cars and trucks. This test however, it is an advisory test only and vehicles are not failed for this portion of the test.

Based on IM 240 lane data, 2,340 1996 and newer vehicles failed the IM 240 test and also had a matched OBD II record in the database. Of these, 33%, or 772 vehicles would have passed a hypothetical OBD II program meeting EPA's "readiness"<sup>1</sup> criterion. There were 511 vehicles, or 22%, that failed IM 240, but passed the OBD check with all monitors set to ready.

<sup>1</sup> "Readiness" monitors are used to indicate how many, and how which, tests the system has run to determine emissions status. If all monitors have been run and no faults were found the assumption is made that the vehicle is "clean." EPA allows up to two monitors not set to ready for MY 2000 and older, and one unset monitor for 2001 and newer vehicles.

## Remote Sensing Device Program

### RSD Program Results

During 2007 the total number of RSD systems in Colorado increased from nine to eighteen. As a consequence of increased RSD monitoring, the number of RSD records generated, as well as vehicles eligible to be clean screened increased. Figure 11 illustrates this change.

Figure 11

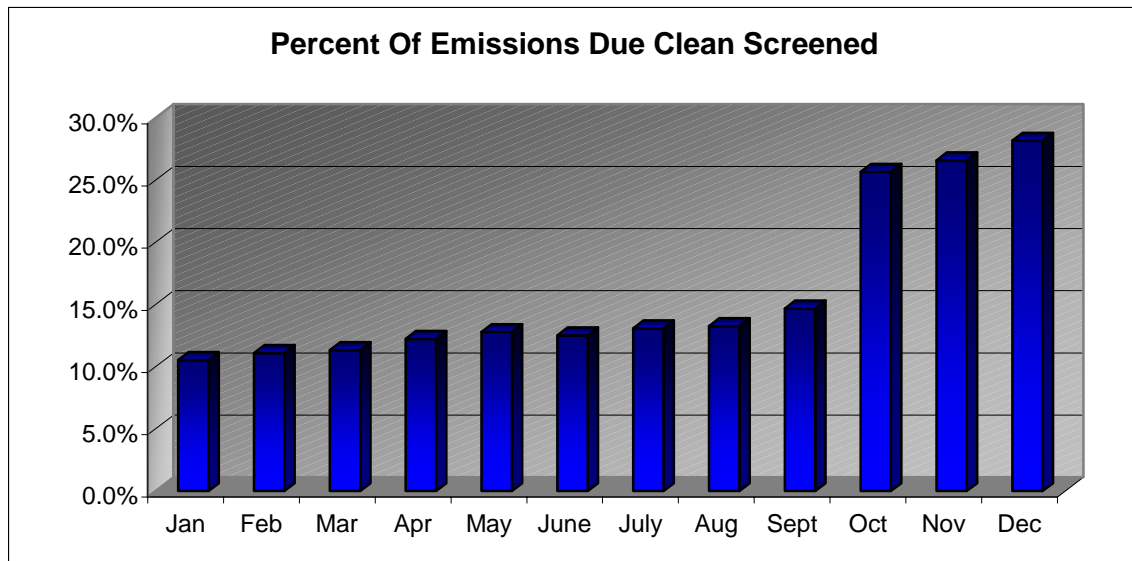
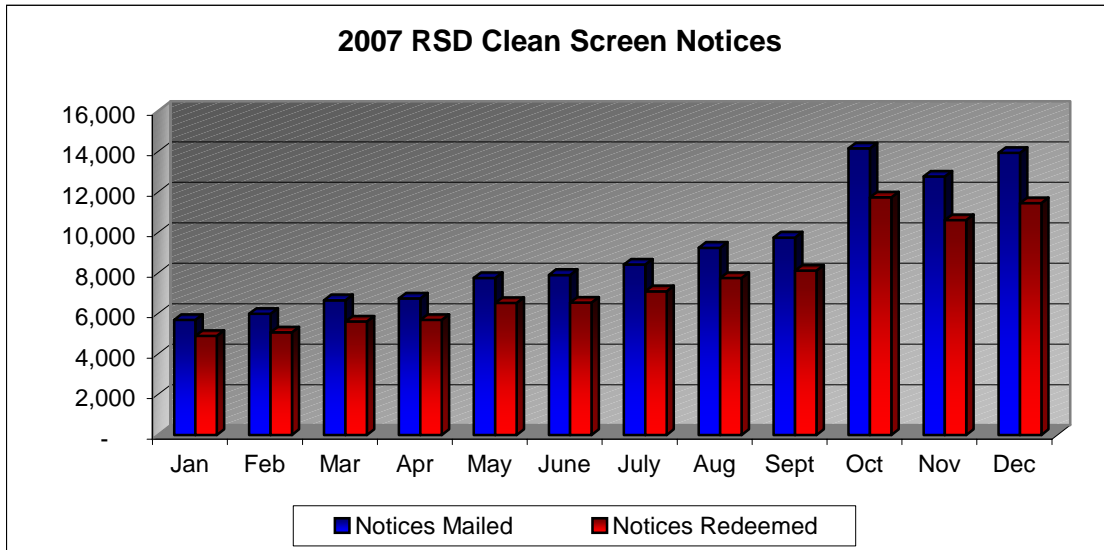


Figure 12 shows the number of clean screen notices mailed as compared to the number of notices redeemed with the Department of Revenue. The average redeemed for the year was 86% of the notices mailed.

Figure 12

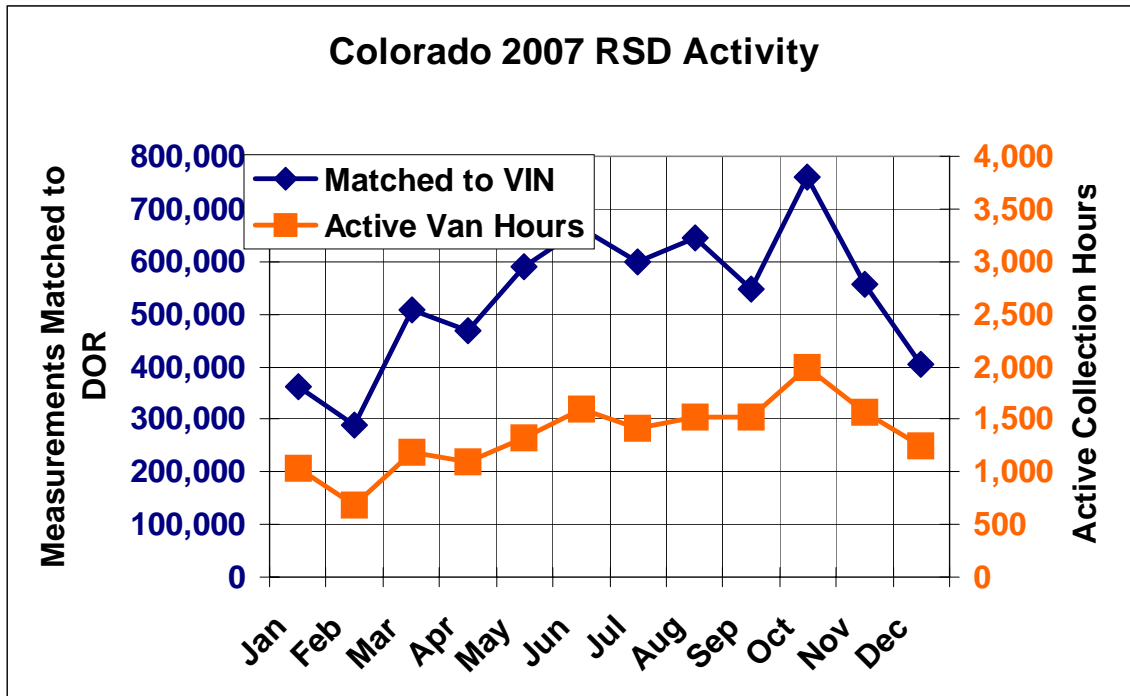


For the year, 109,014 vehicles were screened by remote sensing and identified as clean. This compares to 43,095 vehicles in 2006 and 19,293 vehicles in 2005.

As part of the State Implementation Plan (SIP), RSD vehicle observations cannot exceed more than 50% of the emissions testable fleet. A vehicle observation is defined as any vehicle seen at least twice and qualifies to make a clean/dirty determination. For 2007 the RSD observed fraction of testable vehicles was 19.08%. This is based on 729,145 total eligible vehicles in the fleet and 139,146 unique eligible vehicles observed by RSD. Also in 2007 there were a total of 16,163 active van-hours that generated 6,393,205 total valid, vehicle identification number (VIN) matched records. Figure 13 presents RSD activity by month.



Figure 13



## COST EFFECTIVENESS OF THE PROGRAM

### Calculation of Program Costs

The Division estimates that the entire program cost was approximately 29 million for 2007. This cost includes inspection costs, repair costs, and registration renewal fees used to fund administrative costs. It does not include the convenience expense of motorists' time or their mileage costs.

The biennial fee for the IM240 inspection in the enhanced area is \$25. The annual fee for the idle test has an upper limit of \$15. Registration renewal fees include a \$2.20 fee to offset the cost of enforcing and administering the program.

The average cost of repairs for vehicles failing the IM240 inspection is \$309. The average cost of repairs for a vehicle failing the idle test in the enhanced area is \$226<sup>2</sup>. These repair costs are based on a sampling by survey of individual vehicles that required repairs. The cost of the program is partially offset by increased fuel economy to repaired vehicles. In these calculations, fuel economy improvements and repairs are assumed to last for two years.

<sup>2</sup> Of 37,313 after-repairs tests, 35,562 had no cost information in the repair record. Therefore, cost information is based on only 4.58% of the after-repairs tests.

## **Cost-Effectiveness**

The Air Pollution Control Division estimates the cost effectiveness of the inspection program at \$7,070 per ton of removed ozone precursors. For purposes of this estimate the full benefit of NO<sub>x</sub> and HC, plus 1/60 of the CO benefit are added together. A reduced CO benefit is used because of the lower reactivity of CO for ozone formation. For wintertime carbon monoxide the cost effectiveness is estimated at \$513 per ton.

# **ANNUAL REPORT FROM THE COLORADO DEPARTMENT OF REVENUE**

During 2007, the Colorado Department of Revenue (DOR) maintained audit and enforcement activities consistent with state statute and rule.

## **Audits**

Every thirty days a record audit is performed on all contractor enhanced inspections centers and inspection-only sites. Of 230 audits performed in 2007, 49 warnings were issued.

Performance audits were also executed every 90 days on all enhanced I/M 240 lanes. Out of 895 lane performance audits conducted, 48 inspectors received scores resulting in less than 100%. Evaluation of all independent inspection-only facilities and enhanced fleet stations resulted in 311 performance audits. Three analyzers were locked out for calibration issues.

During 2007, 314 enhanced lane equipment audits were performed on enhanced inspection lanes and independent test-only centers with 115 initial equipment audit failures or 36.6%. All but one returned to service the same day. Additionally, 20 equipment audits were performed at inspection-only stations with two audits failing for equipment calibration problems. Of 21 fleet-inspection station audits, one analyzer failed resulting in a lockout condition.

Every 30 days all enhanced inspection centers were subjected to covert audits for vehicles with emissions equipment either removed or tampered. Possible tampering violation screenings included, but were not limited to, removed or tampered catalytic converters, A.I.R. systems, O<sub>2</sub> sensors, and fuel inlet restrictors. Throughout 2007 168 covert inspections were conducted at enhanced inspection center lanes with 108 tests conducted correctly, and 60 tests not properly administered. Of the 60 tests done incorrectly, 49 were due to passing a tampered vehicle. There were multiple violations on most covert inspections resulting in a total of 284 violations. Seven inspections were conducted at independent inspection-only facilities with no violations issued.

Clean screen (called RapidScreen) mobile emissions testing equipment audits were also performed by the DOR for quality assurance checks. . Audits were performed on each system every five days or less. There were 264 audits performed with 28 Phase I failures or 10.6%. Of the 28 failures, all but three were immediately returned to service after passing a phase II audit.

## **Fines**

During 2007, 119 hearings were conducted with all charges sustained. Fifty-eight inspectors were placed on probation, while six inspectors were suspended. Fines of

\$135,400 were collected.

Fines in the amount of \$219,621 were collected when the inspection wait time at enhanced inspections centers was longer than 15 minutes, averaged over a 2-hour period. Additional fines of \$19,400 were collected for other violations stemming from consumer complaints and various inspection procedural violations. Fines collected in 2007 totaled \$374,421.

### **Complaints**

A total of 471 complaints were lodged against enhanced inspections centers and resolved by DOR resulting in \$83,399 refunded to consumers. The DOR responded to 55 complaints against independent inspection stations and auto dealerships. A total of \$46,692 was refunded to consumers from these proceedings.

### **Waivers**

In 2007, 380 waiver applications were submitted and processed by the Department of Revenue. Of those applications, 159 or 42% met statutory requirements and were approved. The DOR also issued an additional 19 hardship waivers to vehicle owners as a result of an economic hardship qualified by documented public assistance or welfare. The major causes for waiver rejection were as follows:

- **Improper repairs to the vehicle** - repairs performed that did not address the cause of the emissions failure.
- **No after repairs failing retest** - vehicle had not completed the required after repairs test indicating the vehicle continues to fail after completion of necessary repairs.

**Minimum waiver limits for dollars spent to repair the vehicle had not been met** - vehicle owner had not incurred the minimum \$715 in repair costs attempting to bring the vehicle into compliance

## ADDITIONAL REPORTS

In addition to this report, the following detailed data reports are available in the appendix of this document:

<b>Report</b>	<b>Objective</b>
<b>Initial Inspection Report Appendix A</b>	Identify and report AIR Program initial inspection pass/fail statistics including average emissions results for overall total, passing and failing inspections by model year and vehicle class.
<b>Initial Failure Report Appendix B</b>	Identify and report AIR Program initial inspection failure statistics including average emissions results for inspections which failed for both exhaust and visual components, exhaust only, and visual only by model year and vehicle class.
<b>Initial Visual Failure Report (Advisory) Appendix C</b>	Identify and report AIR Program initial visual advisory failure statistics by model year and vehicle class.
<b>Initial Visual Failure Report (Mandatory) Appendix D</b>	Identify and report AIR Program initial visual mandatory failure statistics by model year and vehicle class.
<b>Retest Frequency Report Appendix E</b>	Identify and report the number of retests by model year and vehicle class.

