

COMMONWEALTH OF MASSACHUSETTS  
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## 2007 Annual Report

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Massachusetts Enhanced Emissions and Safety Test  
Inspection and Maintenance Program

September 29, 2008

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## **2007 Annual Report**

### **Massachusetts Enhanced Inspection and Maintenance Program**

#### **1 EXECUTIVE SUMMARY**

This document is the 2007 Annual Report to the United States Environmental Protection Agency (EPA) on the Massachusetts Enhanced Inspection and Maintenance program (I&M program). This report covers the calendar year January 1 to December 31, 2007.

This Annual Report is required by EPA under 40 CFR 51.366. This regulation requires that annual reports cover four categories of information:<sup>1</sup>

- Station and inspector oversight,
- Quality control,
- Compliance and enforcement, and
- Emissions test data.

#### **1.1 Major Findings**

##### ***Emissions Tests Conducted***

A biennial emissions test is required for the majority of the fleet. (Exemptions include vehicles less than two years old and pre-1984 vehicles). An emissions test is also required when a vehicle changes ownership and when a vehicle is relocated to Massachusetts. An annual safety test is also required of all vehicles.

In 2007, there were approximately 4.6 million vehicles registered in Massachusetts. The I&M program conducted initial emissions tests on 1,942,731 unique vehicles (42% of the Massachusetts fleet). Of the vehicles that received initial emissions tests in 2007, 1,899,718 were gasoline fueled and 43,013 were diesel fueled. Massachusetts is one of the few states that goes beyond EPA requirements by routinely testing heavy duty diesel trucks and buses for excess emissions as part of its effort to reduce the significant health problems associated with diesel exhaust.

In total, the I&M program conducted emissions tests on 2,090,473 gasoline- and diesel-fueled vehicles in 2007, including initial tests, retests, and off-cycle tests due to changes of ownership/registration.

##### ***Compliance and Enforcement***

Of the 4.6 million vehicles registered in Massachusetts in 2007, 4.47 million (96.7%) were tested for safety or for safety and emissions. Of the 1,899,700 gasoline-fueled vehicles receiving initial emissions tests in 2007, 176,200 (9.3%) failed their initial emissions tests. Of these failures, 143,300 (~81.3%) passed a subsequent retest, or received a waiver by March 31, 2008.

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<sup>1</sup> See "Attachment A: Index of Report Pages Relevant to EPA Regulation Sections" for details about where specific required items appear in this report.

Of all gasoline-fueled vehicles tested, 33,000 (1.7%) did not pass a subsequent retest or obtain a waiver. One hundred and eighty four waivers from the requirement that failing vehicles pass an emissions re-test were granted in 2007 (less than 0.01% of both vehicles receiving initial emissions tests and vehicles failing initial emissions tests). While some of the vehicles that failed an initial test and did not pass a re-test were taken off the road with expired registrations, sold out of state, or junked, vehicles failing to receive inspections or emissions tests when required are subject to enforcement by the Registry of Motor Vehicles (RMV) as well as by state and local law enforcement agencies.

***Emissions Reductions From Transient Tested Vehicles***

EPA requires states to calculate emission reductions from vehicles that are repaired after failing a “transient” emissions test (This is one of the three types of emissions tests used in Massachusetts. It measures specific pollutants in tailpipe exhaust from gasoline-fueled vehicles). 24,100 transient-tested vehicles that had failed their emissions test in 2007 were successfully repaired and passed a subsequent transient test. Based on the emissions data for these vehicles’ initial failing transient test and their subsequent passing retests, these repairs reduced the emissions of those vehicles by an average of 73% for hydrocarbons, 80% for carbon monoxide and 60% for oxides of nitrogen.

***Station and Inspector Oversight***

In 2007, the Massachusetts Registry of Motor Vehicles (RMV) performed 5,781 site audits to determine if the inspectors were correctly performing all safety and emissions tests and if the station’s physical conditions continued to meet program requirements. All 1,408 stations operating throughout the year received at least one visit. Based on the results of the site audits and other data, the RMV held 393 hearings for stations and issued 247 adverse actions against stations (e.g. license revoked or suspended).

During 2007, 5,911 licensed inspectors performed at least one test during the year. Based on the results of the site audits and other data, the RMV held 397 hearings for inspectors, and issued 203 adverse actions (e.g., license revoked, suspended, or suspended pending retraining). The adverse actions taken against inspectors ranged from requiring retraining to revoking inspector licenses.

***2007 Program Improvements***

In 2007, the program continued to improve the accuracy and reliability of emission testing equipment, an effort that started with a contract amendment (No. 4) signed in June 2004 that:

- established specific reliability standards for testing equipment,
- required all testing equipment to be upgraded or replaced, and
- required the contractor to significantly increase its maintenance and monitoring of workstations, to provide early identification of needed adjustments and repairs.

Massachusetts Department of Environmental Protection (MassDEP) continued its program of auditing inspection equipment performance throughout 2007 to ensure that the contract amendment was achieving its goals. 2007 was the second year in which

MassDEP used its audits to evaluate whether workstations were functioning within the contractually-required equipment reliability standards.

2007 was also the first full year in which an additional contract amendment (No. 6) was in effect. This amendment (which was signed on May 30, 2006) extended the contract through September 30, 2008, and also established additional requirements for the program contractor, within the framework of the reliability standards established by Contract Amendment No. 4. The new contract amendment required the contractor to:

- Improve its response time to requests from inspection stations for workstation repairs,
- Meet performance standards for workstation maintenance and repairs identified by digital and MassDEP audits,
- Upgrade workstation software to correct gas bench response times and VMAS flow adjustments,
- Reformat the Vehicle Inspection Report and implement a communications plan to encourage motorists to use a Registered Repairer for emission control system repairs,
- Implement updated and expanded training for emission control repair technicians, and
- Correct the protocol for inspecting heavy-duty vehicles to require that parking brakes are “off” before an inspection is performed.

The contract amendment included schedules for each requirement and performance standards to help ensure that the program contractor meets the requirements throughout the remaining term of the extended contract (September 2008).

In 2007, the Agencies started procurement of a new contract for implementing the Massachusetts I&M program from October 1, 2008 through September 30, 2013. The Agencies developed specifications for the new program and issued a “Request for Responses” on April 5, 2007; responses were received by July 6, 2007. During the remainder of 2007, the Agencies reviewed the responses, selected a new contractor and negotiated the terms of the new contract, which was signed on January 16, 2008. The 2008 Annual Report will describe the transition to the new program.

## **1.2 Contents of This Report**

Section 2 of this report describes the Massachusetts I&M Program and provides information on the number of vehicles covered, inspection stations and inspectors, and types of emissions tests administered. The remaining sections of the report describe specific aspects of the program:

- Motorist Compliance with Testing Requirements (Section 3)
- Performance of Emissions Test Equipment (Section 4)
- Station and Inspector Oversight (Section 5)
- Emissions Test Results (Section 6)

The attachments to this report contain detailed data on vehicles tested, results of emissions tests, and audit results:

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- Attachment A: Index of Report Pages Relevant to EPA Regulation Sections
- Attachment B: RMV Re-test Reminder Letter
- Attachment C: Detailed 2007 Emissions Test Data
- Attachment D: 2007 Test Data by Station
- Attachment E: 2007 Quality Control Report

## 2 THE MASSACHUSETTS I&M PROGRAM

### 2.1 Why Does Massachusetts Have an I&M Program?

Massachusetts continues to be in non-attainment with federal standards for ground-level ozone pollution. On “bad air” days, there are increases in asthma attacks and hospitalizations for people with severe respiratory ailments. To reduce the number of “bad air” days and to comply with the federal Clean Air Act and U.S. Environmental Protection Agency (EPA) regulations, Massachusetts must implement a variety of federally mandated programs.<sup>2</sup> To reduce pollution from motor vehicles, Massachusetts is required to operate an Enhanced Inspection and Maintenance (I&M) program. EPA sets minimum standards for I&M programs<sup>3</sup>.

The current Massachusetts I&M program was authorized by the Legislature by Chapter 210 of the Acts of 1997. The Department of Environmental Protection (MassDEP or the Department) and the Registry of Motor Vehicles (RMV) jointly administer the Enhanced Emission and Safety Test Program. The program’s goals are to implement a comprehensive test that provides the emission reductions needed for the Massachusetts state implementation plan (SIP), is convenient to motorists, ensures vehicle safety, and works well in local inspection shops. To maximize customer convenience, the legislation combines emissions and safety testing, and requires that the combined test be delivered in local inspection stations, convenient to where people live and work. In January 1999, the Commonwealth contracted with Keating Technologies, Inc. (which changed its name to Applus Technologies, Inc. in February 2005<sup>4</sup>), to supply the inspection equipment and operate the Massachusetts I&M program.

### 2.2 Vehicles Subject to Inspection

40 CFR 51.366 (d) (1) (i): An estimate of the number of vehicles subject to the inspection program, including the results of an analysis of the registration data base;
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In 2007, there were approximately 4.6 million vehicles with active registrations in the Massachusetts fleet. Each vehicle registered in Massachusetts must be inspected annually. All vehicles must receive a safety inspection every year, and the vast majority must receive an emissions test every other year. In 2007, vehicles were exempted from the emissions inspection if they were:

- Model year 1984 or older, or
- Less than 2 years old and still registered to the original owner.

<sup>2</sup> These programs are established in legally binding and federally enforceable “State Implementation Plans” or “SIPs”.

<sup>3</sup> 40 CFR Part 51, Subpart S (§51.350 et seq.).

<sup>4</sup> In July 2001, the Contractor changed its name to “Agbar Technologies, Inc.”, and in February 2005, changed its name again to “Applus Technologies, Inc”. In this report, the Contractor is referred to as “Applus”, since the firm did business under this name during the year covered by this report.

Vehicles are required to receive an emissions inspection within seven days of transfer of ownership, or within seven days of their initial Massachusetts registration when moving registration from another state. In addition, vehicles that are more than 60 days late for a scheduled safety-only test are also tested for an emissions test.

### 2.3 Inspection Stations

40 CFR 51.366 (b)<sup>5</sup> (1): The number of inspection stations and lanes:

- (i) Operating throughout the year; and
- (ii) Operating for only part of the year;

Most Massachusetts vehicles receive their inspections at local public stations. The program also allows owners of vehicle fleets to purchase their own testing equipment so they can test their own vehicles. The number of public and fleet stations fluctuates slightly from month to month as businesses join or leave the program.

In 2007, 1,408 stations conducted emissions tests throughout the year, and another 248 conducted tests during part of the year. There were 1,465 “workstations” or sets of inspection equipment used for testing emissions throughout 2006, and 172 workstations used for testing during part of the year (See Table 1 below). A small number of inspection stations have more than one workstation. At any given time, some of the workstations and stations are not operating, due to factors such as change of ownership or location. The number of workstations and stations testing in any given month is fewer than the total number of workstations and stations, as seen by the number of stations and workstations testing in December, shown in Table 1. In Massachusetts, the number of workstations is equivalent to the number of lanes in a centralized testing program.

**Table 1: Number of Stations and Workstations in 2007**

	Workstations <sup>6</sup>	Stations
Testing All Year	1,465	1408
Testing for Part of Year	172	248
Total During Year	1,637	1656
Testing in December	1,566	1,533

Table 2 shows the breakdown of fleet and public stations. Of the 1,408 stations that conducted emissions tests throughout 2007, 1,360 were public stations and 48 were fleet

<sup>5</sup>For all references to 40 CFR 51.366: 57 FR 52987, Nov. 5, 1992, as amended at 61 FR 40945, Aug. 6, 1996; 65 FR 45534, July 24, 2000; 66 FR 18178, Apr. 5, 2001.

<sup>6</sup> If a workstation was moved to a different station during 2007, it was counted as the same workstation, but as a different station. Relocated workstations may have tested for all or part of the year. These statistics reflect the circumstances of each relocated workstation.

stations. An additional 187 public stations and 61 fleet stations conducted emissions tests during part of the year.

**Table 2: Public and Fleet Stations in 2007**

	Public	Fleet	Total Stations
Testing All Year	1,360	48	1,408
Testing for Part of Year	187	61	248
Total During Year	1,547	109	1,656
Testing in December	1,461	72	1,533

In Tables 1 and 2, a station or workstation must have conducted emissions inspections in each month in 2007 to be counted as “testing all year.” Stations or workstations that were licensed for the entire year, but did not test in one or more months are considered “testing for part of the year,” as are stations that entered or left the program during the year.

## 2.4 Inspectors

40 CFR 51.366 (b) (5): The number of inspectors licensed or certified to conduct testing;

At the close of calendar year 2007, there were 6,470 trained and licensed inspectors certified to conduct emission tests (See Table 3). However, only 5,911 inspectors tested at least one vehicle during the year.

**Table 3: Number of Inspectors in 2007**

	# Of Inspectors
Inspectors Trained And Licensed on December 31, 2007	6,470
Inspectors Who Inspected at Least One Vehicle in 2007	5,911

## 2.5 Emissions Tests Administered

The Massachusetts I&M Program uses four different emissions tests. The workstation software determines what tests a vehicle will receive. Gasoline-fueled vehicles receive one of the following tests: On-Board Diagnostic, transient (tailpipe), or two-speed idle (tailpipe). Diesel-fueled vehicles (heavy-duty only) receive a snap acceleration (opacity) test. Each test is described below.

1. On-Board Diagnostic: All model year 1996-and-newer gasoline-fueled cars and light trucks have “On Board Diagnostic” (OBD) computers and sensors that assess the condition of the vehicle’s emissions control systems. The emissions test accesses the OBD system in these vehicles to find out whether the emission control system is working properly. Starting on June 15, 2004, all vehicles equipped with modern OBD systems (i.e., OBD II) passed or failed their emissions tests based on the data in those systems. In 2007, 78.8% of vehicles receiving initial emissions tests were tested using the OBD test.

2. Transient tailpipe tests are used for most gasoline-powered vehicles that are not equipped with modern OBD systems. In this test, vehicles are placed on a dynamometer, a treadmill-like device that puts resistance against the tires to simulate on-road driving. The vehicles are accelerated and decelerated according to a prescribed pattern (“drive trace”), and tailpipe emissions are measured and recorded. Readings for hydrocarbons (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NO<sub>x</sub>) are compared to each pollutant’s pass/fail points, which are expressed in grams/mile. The pass/fail points vary by vehicle type [car vs. truck], model year, and, for trucks, by weight category. In 2007, 16.2% of vehicles receiving initial emissions tests were tested using the transient test.

3. Two-speed idle (TSI) tests are used for gasoline-fueled vehicles that cannot receive an OBD or transient test. This test measures emissions while the engine is operating at 2500 revolutions per minute with the transmission in neutral, and while the vehicle is idling. The pollutant levels and pass/fail points for TSI tests are measured in concentrations (parts per million for HC, and percent-per-standard volume for CO). This test does not measure emissions of oxides of nitrogen. All vehicles receiving a TSI tailpipe emission inspection are also visually inspected to confirm that various emissions components, such as the catalytic converter, are present with no apparent tampering. If a vehicle fails the visual inspection, it fails the overall emissions test, even if the vehicle passed the tailpipe portion of the test. Examples of vehicles that receive a TSI test are those with all-wheel drive (where the vehicle cannot be shifted back to two wheel drive) and gasoline-fueled vehicles over 10,000 pounds Gross Vehicle Weight Rating (GVWR). In 2007, 2.8% of all vehicles receiving initial emissions tests were tested using the TSI test.

4. The snap acceleration test uses an opacity meter to identify excess emissions from heavy-duty diesel trucks and buses (e.g., vehicles weighing more than 10,000 pounds GVWR). While not required by EPA, Massachusetts devotes resources to diesel testing because diesel exhaust is linked to significant health problems. Every diesel vehicle that is repaired through this program results in an improvement in air quality for children riding school buses, for people living next to busy urban streets, and for the thousands of Commonwealth residents who suffer from asthma. Diesel testing started in February 2001. In 2007, heavy-duty diesel vehicles comprised 2.2% of all vehicles receiving an initial emissions test.

Please note that gas caps are tested for most gasoline-fueled vehicles. If a vehicle fails the gas cap test, it fails the overall emissions test, even if the vehicle passed the tailpipe or OBD portion of the test.

### 3 MOTORIST COMPLIANCE WITH TESTING REQUIREMENTS

#### 3.1 Overall Motorist Compliance with Testing Requirements

40 CFR 51.366 (d) (1) (ii): The percentage of motorist compliance based upon a comparison of the number of valid final tests with the number of subject vehicles;

Table 4 summarizes the overall 2007 compliance rate, which compares the total number of unique vehicles receiving an I&M test (including safety-only tests) to the average number of unique registered vehicles during the year. In 2007, this compliance rate was 96.7%

**Table 4: 2007 Overall Testing Compliance Rates**

	Vehicle Count	Compliance %
Vehicles Subject to 2007 Test (Safety Only or Safety and Emissions)	4,620,000	
Unique Vehicles Tested in 2007 (Safety Only or Safety and Emissions Tests)	4,465,410	96.7%

Please note that a compliance rate specifically for emissions tests cannot be calculated due to insufficient data. In 2007, 32,964 (18.7%) of the 176,247 gasoline-fueled vehicles that failed their initial emissions tests did not pass a re-test by March 31, 2008 (the re-test would be considered a “final test” as per EPA’s requirement noted above). However, data indicating the number of vehicles that should have obtained an initial emissions test is not available because the Commonwealth does not track the number of registered vehicles that are exempt from the emissions testing requirement (those that are less than two model years old, or were made in model year 1984 or earlier).

#### 3.2 Registration File Audits and Compliance with Deadlines

40 CFR 51.366 (d) (2) (ii): [Registration denial based enforcement programs shall provide. . . ] The number of registration file audits, number of registrations reviewed, and compliance rates found in such audits. . . .

40 CFR 51.366 (d) (3): Computer-matching based enforcement programs shall provide the following additional information:

(i) The number and percentage of subject vehicles that were tested by the initial deadline, and by other milestones in the cycle;

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The RMV typically completes two scans of the vehicle registration database each month. These registration reviews examine the testing status of each registered vehicle to determine compliance with testing requirements.

Table 5 (below) summarizes the results of these registration reviews for 2006. Please note that the compliance rate is typically higher in the middle of the month than at the start of the month, indicating that a significant number of vehicles were inspected between one day and two weeks after the inspection was due.

Please note that the proportion of the vehicle fleet found to be “in compliance” with inspection requirements by the bi-monthly registration reviews is lower than the proportion determined to be in compliance based on data from the full calendar year (89.2% vs. 96.7% respectively).

Registration reviews (as described in Table 5 below) are snapshots in time, and therefore tend to understate compliance. Registration reviews determine whether the most recent inspection for each vehicle was performed within the last 12 months and was a “pass.” The I&M regulations allow up to 60 days for emissions repairs. The registration reviews count vehicles that failed their emissions test as “out of compliance” if they have not completed repairs and passed a re-inspection by the time of the registration review, even though the vehicle may still be within its 60-day period. Also, registration reviews only capture compliance status at a particular moment in time. A vehicle that was tested seven weeks late in 2007 would ultimately have been in compliance but would have been counted as out-of-compliance on four registration reviews.

Alternatively, the compliance rate in Table 4, which based on the number of unique vehicles tested during the full calendar year, may overstate compliance. The number of vehicles subject to the test (the denominator, from Table 4) is the average of the number of vehicles found to be registered in each of RMV’s registration reviews. In contrast, the numerator is the number of unique vehicles that were tested during the year, even though some of these vehicles may not have been registered for the whole year.

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**Table 5: 2007 RMV Registration Reviews**

Date	Active Registrations	Number Non Compliant	Percent In Compliance
1/1/2007	4,578,233	515,854	88.7%
1/15/2007	4,593,320	454,254	90.1%
02/01/07	4,600,627	542,636	88.2%
02/15/07	4,585,510	478,007	89.6%
3/1/2007	4,596,652	547,693	88.1%
3/15/2007	4,587,162	481,010	89.5%
4/1/2007	4,575,392	545,279	88.1%
4/15/2007	4,597,565	479,227	89.6%
5/2/2007	4,615,488	549,746	88.1%
5/16/2007	4,610,906	468,756	89.8%
06/01/07	4,637,804	543,157	88.3%
6/15/2007	4,635,922	463,922	90.0%
07/01/07	4,620,439	528,897	88.6%
7/15/2007	4,641,450	461,622	90.1%
8/1/2007	4,657,963	531,823	88.6%
8/15/2007	4,649,579	454,232	90.2%
9/1/2007	4,661,234	536,513	88.5%
9/15/2007	4,647,680	456,082	90.2%
10/01/07	4,654,639	540,746	88.4%
10/15/2007	4,600,069	459,386	90.0%
11/1/2007	4,646,069	526,731	88.7%
11/15/2007	4,624,461	452,205	90.2%
12/1/2007	4,633,827	520,242	88.8%
12/15/2007	4,619,046	453,043	90.2%
<b>Average</b>	4,619,627	499,628	89.2%

### 3.2.1 PARKING LOT SURVEYS

40 CFR 51.366 (d) (4) (iii): [Sticker-based enforcement systems shall provide . . . ] The number of parking lot sticker audits conducted, the number of vehicles surveyed in each, and the noncompliance rate found during those audits.

Table 6 summarizes the results of 2007 parking lot surveys conducted by the RMV.

**Table 6: 2007 Parking Lot Surveys**

Parking lot audits conducted	91
Vehicles surveyed	2275
Vehicles with valid inspection stickers	2159
Compliance rate	94.9%

The RMV’s registration enforcement program, originally scheduled to begin in late 2004, had not been implemented by the end of 2007. However, on February 25, 2007, RMV started to send letters to owners of all vehicles that had not passed a retest 30 days after they failed an initial inspection (Attachment B contains a sample letter). Between February 25, 2007 and December 31, 2007, 120, 400 letters were sent. This reminder appears to have been effective: In calendar year 2007, the percentage of gasoline-fueled vehicles that failed an initial emissions test and did not pass a subsequent retest or obtain a waiver was 18.7%, compared with 26.2% in 2006.

### 3.2.2 RMV COMPLIANCE SURVEYS

40 CFR 51.366 (d) (1) (vi): The number of compliance surveys conducted, number of vehicles surveyed in each, and the compliance rates found;

The RMV conducted registration file audits and parking lot surveys, as described in Sections 3.2 and 3.2.1 respectively. No other compliance surveys were conducted in 2007.

### 3.2.3 MOTORIST TIME EXTENSIONS

40 CFR 51.366 (d) (1) (v): The number of time extensions and other exemptions granted to motorists;

No time extensions and other exemptions were granted to motorists, beyond the program’s standard exemptions for certain classes of old or new vehicles.

### 3.2.4 PREVENTING FALSE REGISTRATION BY MOTORISTS

40 CFR 51.366 (d) (2) (i): [Registration denial based enforcement programs shall provide . . . ] A report of the program’s efforts and actions to prevent motorists from falsely registering vehicles out of the program area or falsely changing fuel type or weight class on the vehicle registration, and the results of special studies to investigate the frequency of such activity; and

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40 CFR 51.366 (d) (3) (ii): [Computer-matching based enforcement programs shall provide . . . ] A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity;

40 CFR 51.366 (d) (4) (ii): [Sticker-based enforcement systems shall provide . . . ] A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity;

The reporting requirements for efforts to prevent false registration are not relevant to Massachusetts because:

- All of Massachusetts is covered by the program;
- All vehicles are required to be inspected annually for either safety or safety and emissions;
- If a motorist falsely reports fuel type or weight in order to avoid an emissions inspection, the inspector enters corrected data based on his or her examination of the fuel cap and the vehicle information appearing on the vehicle's door label.

### 3.2.5 ADDITIONAL STICKER-RELATED ACTIVITIES

40 CFR 51.366 (d) (4): Sticker-based enforcement systems shall provide the following additional information:

(i) A report on the program's efforts to prevent, detect, and enforce against sticker theft and counterfeiting, and the frequency of this type of activity;

To support the state and local police with inspection-sticker motor-vehicle violations, the RMV mailed a detailed memorandum to state and local police departments in the Commonwealth regarding sticker characteristics for 2007.

On a monthly basis, the RMV also analyzed monthly digital audits, which include the number of offline inspections, model year changes, failure rates and emissions testing rates, and used the result of the analysis to determine targets for overt audits.

In 2007, state and local police issued 92,989 inspection-sticker motor-vehicle violations.

## **4 PERFORMANCE OF EMISSIONS TEST EQUIPMENT**

This section summarizes the findings of more than 9,200 audits of emissions testing equipment conducted by MassDEP and Applus Technologies, Inc. in 2007. The complete Quality Control Report, with detailed information about the equipment audits and results, can be found in Attachment E. In addition to the results of MassDEP equipment audits, this section summarizes the equipment improvements and equipment performance standards covered by Contract Amendments Nos. 4 and 6, reports whether the performance standards established by Contract Amendment No. 4 were met. This section also describes the results of equipment audits performed by the contractor, Applus.

MassDEP's equipment auditing program is designed to determine whether emissions testing equipment meets stringent performance standards ("audit criteria") established by the Massachusetts I&M program. Equipment audits are on-site inspections of emissions testing equipment performed throughout the year at working inspection stations. Equipment audits are performed overtly and are either randomly selected or targeted. MassDEP's audits are performed by agency staff and SGS Testcom (a firm that holds a separate contract with MassDEP, and has no business ties to Applus).

As per EPA requirements [40 CFR 363 (c)] and guidance, each state establishes equipment audit criteria and performance standards for its I&M program, based on its own program objectives. States can choose to include additional audit criteria not required by EPA, and some states select performance standards for the equipment audit criteria that differ from EPA guidance. MassDEP's audit criteria are listed in Attachment E.

Massachusetts's criteria are more rigorous and significantly stricter than what EPA requires: while EPA's criteria include 64 checks, Massachusetts' audits cover 88 checks (including everything required by EPA). If a workstation fails to meet one or more of the 88 audit criteria, then that workstation fails the audit, regardless of whether the failure may affect the results of an emissions test. Follow-up audits occur at stations failing items deemed critical during initial or follow-up audits.

### **4.1 MassDEP Audit Coverage of the Inspection Station Network**

40 CFR 51.366 (c) Quality control report. ...Basic statistics on the quality control program for January through December of the previous year, including:

- (1) The number of emission testing sites and lanes in use in the program;
- (2) The number of equipment audits by station and lane;

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In 2007, 1,408 stations and 1,465 workstations (lanes) conducted emissions inspections throughout the year. 1,656 stations and 1,637 workstations conducted emissions tests at some time during the year. These numbers include workstations and stations that are configured for “diesel only” emissions tests and are not subject to equipment audits. In December 2006, 1,503 workstations and 1,471 stations conducted emissions tests for gasoline fueled vehicles and, therefore, were subject to equipment audits.

MassDEP performed a total of 1,951 audits in 2007 of 1,251 different workstations (lanes) and 1,234 different inspection stations. 672 workstations were audited 1 time, 479 workstations were audited two times, 85 workstations were audited three times, 10 workstations were audited four times, four workstations were audited five times and one workstation was audited six times. These audits include re-audits at stations with critical failures during initial or follow-up audits. MassDEP randomly selects workstations to receive audits in each fiscal year. Therefore, there may be some workstations that are not scheduled for audits in any given calendar year.

### 4.2 MassDEP Audit Results

#### 4.2.1 NUMBER OF STATIONS THAT FAILED AN AUDIT IN 2007

40 CFR 51.366 (c) Quality control report. ...Basic statistics on the quality control program for January through December of the previous year, including:

(3) The number and percentage of stations that have failed equipment audits; and

Of the 1,951 equipment audits conducted, 586 failed one or more audit parts, which was a 30.0% failure rate overall. In total, 511 different inspection stations failed at least one MassDEP audit criteria on at least one audit. This constituted 41.4% of the 1,234 stations audited in 2007 and 30.9% of the 1,656 stations that tested at some time during the year. Please note that failing any one of the 88 parts of a Massachusetts audit results in an “audit failure.” Most failures were associated with audit criteria that are minor, in that they do not directly affect the outcome of emissions tests (e.g., a clock that is not within five minutes of the correct time).

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### 4.2.2 NUMBER OF STATIONS SHUT DOWN DUE TO AN EQUIPMENT AUDIT IN 2007

40 CFR 51.366 (c) Quality control report. ...Basic statistics on the quality control program for January through December of the previous year, including:

(4) Number and percentage of stations and lanes shut down as a result of equipment audits.

Of the 1,951 equipment audits performed in 2007, only 13 (or 0.7% of the audits resulted in workstations being immediately shut down and suspended from performing inspections until repairs could be made. These 13 audits occurred at 13 different workstations located at 13 different stations. They constituted 0.8% of all 1,656 stations and 0.8% of all 1,637 workstations.

Of the 13 workstations that were immediately shut down as the result of an audit:

- Six failed the gas cap tester;
- One failed the inductive RPM pickup;
- One failed both the gas bench and VMAS; and
- Five were shut down due to serious gas bench issues that prevented a calibration after the first bench audit failure (and prevented the subsequent second bench audit).

### 4.2.3 AUDIT FAILURE SUMMARY

Table 7 summarizes the results of equipment audits from 2003 through 2007. Of particular interest is the significant improvement from the 13% failure rate for “combined critical gas bench/VMAS audit” items in 2004 to a 4% failure rate in 2007. Table 7 also demonstrates that the dramatic improvement in the overall audit failure rate, following the June 2004 program changes, continued in 2007. In 2007, 30%, (586 of 1,951) of equipment audits failed one or more of the 88 audit criteria (described in Attachment E), compared with the 31% failure rate in 2006, the 39% failure rate in 2005, the 55% failure rate in 2004 and the 83% failure rate in 2003. As noted in Section 4.2.1 above, most of these audit failures concerned minor audit criteria that do not directly affect the results of emissions tests.

As Table 7 shows, the 2007 failure rates for each audit part were either lower or equal to 2006 failure rates for those parts, with the exception of slight increases in failure rates for the weather station, the OBDII tester, and the second gas bench audit. Each of these exceptions is discussed below.

*Weather station failure rate:* though the weather station failure rate increased from 17% in 2006 to 20% in 2007, the rate maintained its overall improvement from the 47% failure rate found in 2003. Since these failures are caused by poor station maintenance, the significant improvement since 2003 for this audit part reflects improved maintenance by station personnel, as well as by Applus technicians.

*OBDII testers:* Four (0.2% of all such testers that were audited) failed audits in 2007, compared with a 2006 failure rate of 0%. All four 2007 failures were due to problems with a cable or with communication, and were easily repaired.

*Second gas bench failure rate:* The failure rate for second gas bench audits increased from 83% in 2006 to 87% in 2007. This increase is minor, and may be partly due to the small number of second gas bench audits that were conducted (70) in 2007. Second gas bench audits identify gas benches that fail their first audit, are successfully recalibrated, and then fail a second audit. Due to significant improvements in equipment maintenance by the program contractor, many fewer workstations are failing a first gas bench audit, resulting in fewer second bench audits being performed.

While failures of these audits appear to be high, and have increased from 76% in 2003 to 87% in 2007, there are several considerations for an evaluation of this statistic:

- In 2007, MassDEP conducted 1,820 first gas bench audits, of which only 76 failed. Of the first gas bench failures, six had such significant problems that they could not be recalibrated for a second audit, and calls for service were initiated. Of the remaining 70 gas benches that could be recalibrated and audited a second time, 61 (or 87%) failed the second audit.
- Since the number of gas benches that failed their first bench audit has decreased significantly since 2003, the small number of failed second gas bench audits is a large percentage of the number of first gas bench audit failures.
- The high percentage of second gas bench audit failures indicates two qualitative improvements since 2003: 1) these audits are successfully identifying gas benches that experienced a substantive failure after their last audit, and 2) better maintenance conducted by the program contractor generally takes care of small problems, so that these audits are no longer identifying gas benches that have minor problems that are resolved by a calibration.

**Table 7: Equipment Audit Data Summary  
2003 – 2007**

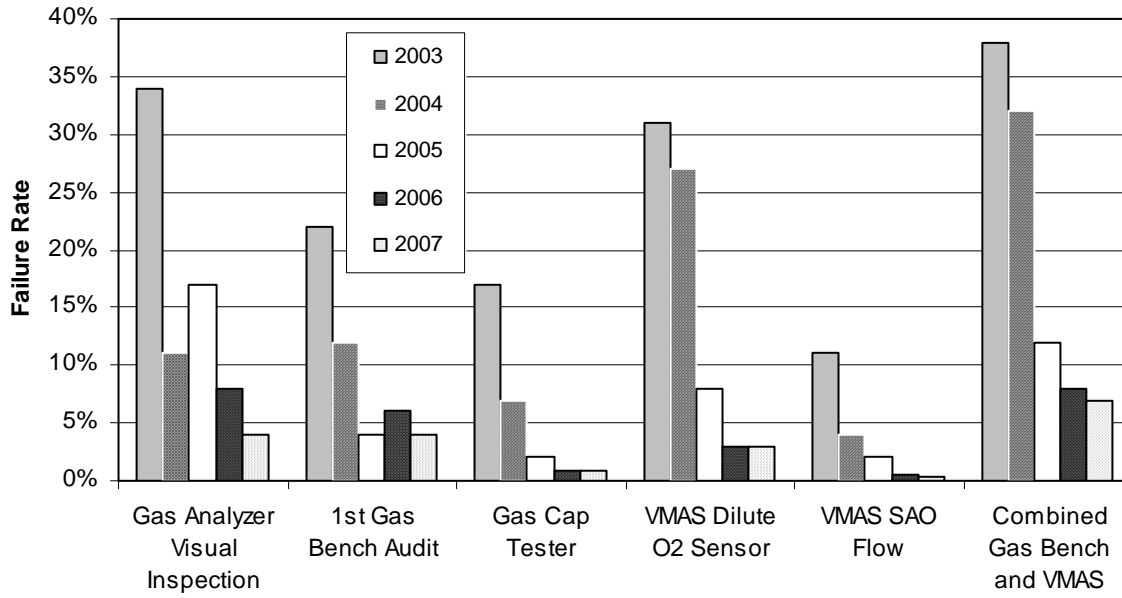
Audit Part	2003 Failure Rate	2004 Failure Rate	2005 Failure Rate	2006 Failure Rate	2007 Failure Rate
Visual Inspection	7%	6%	4%	4%	3%
Gas Analyzer Visual Inspection	34%	11%	17%	8%	4%
Weather Station	47%	27%	21%	17%	20%
Leak Check	44%	7%	1%	1%	<1%
1 <sup>st</sup> Gas Bench Audit	22%	12%	4%	6%	4%
2 <sup>nd</sup> Gas Bench Audit <sup>7</sup>	76%	73%	80%	83%	87%
Gas Cap Tester	17%	7%	2%	<1%	<1%
Inductive RPM Pickup	2%	3%	1%	<1%	1%
OBDII RPM Pickup	1%	1%	<1% <sup>8</sup>	<1%	<1%
OBDII Tester	5%	1%	<1%	0%	<1%
VMAS Visual Inspection	20%	4%	2%	2%	2%
VMAS Dilute O2 Sensor	31%	27%	8%	3%	3%
VMAS SAO Flow	11%	4%	2%	<1%	<1%
Overall Audit Result	83%	55%	39%	31%	30%
Combined Gas Bench and VMAS	38%	32%	12%	8%	7%
Combined Critical Gas Bench/VMAS Audit Items	NA	13%	5%	5%	4%

Table 7 demonstrates that equipment reliability has improved significantly since 2003. Figure 1 compares the 2003 – 2007 failure rates for six equipment components that had very high audit failure rates in 2003. Figure 1 shows that there have been sustained decreases in failure rates for all six of these audit parts since 2003.

<sup>7</sup> Because the 2<sup>nd</sup> gas bench audit is conducted only after an initial bench audit failure and a successful calibration, a relatively small number of workstations receive a second bench audit (132 in 2003, 99 in 2004, 59 in 2005, 98 in 2006, and 70 in 2007).

<sup>8</sup> Beginning in 2005, audit failures less than 1% are indicated as “<1%”.

Figure 1: MassDEP Audit Failure Rates for Select Audit Parts 2003-2007



#### 4.2.4 AUDIT RESULTS FOR CRITICAL ITEMS

Of the critical workstation components, MassDEP monitors the performance of the gas bench and VMAS most closely. Figure 2 includes data from initial audits and re-audits, and presents the failure rate for combined critical gas bench/VMAS audits for 2004 through 2007. This graph highlights the significant improvement in failure rates for the combination of these critical components during the last half of the 2004, and the sustained improvements seen through 2007.

**Figure 2: Combined Critical Gas Bench/VMAS Audit Failure Rate 2004-2007**

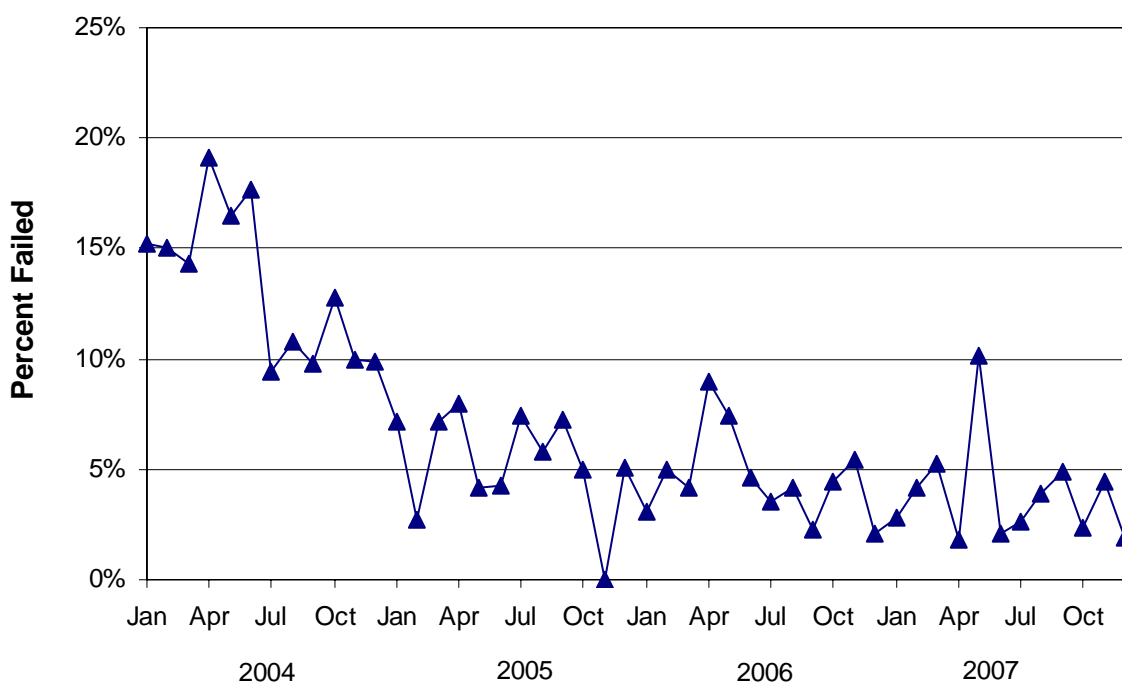


Figure 2 above also shows that the 2007 failure rate was highest in May. This is consistent with the results observed in both 2005 and 2006 for bench components that are tied to seasonal changes in humidity. Applus’ technicians implemented repair strategies and preventative maintenance procedures that limited the seasonal peak in failure rate to only one month in 2007.

### 4.3 Equipment Improvements and Contract Equipment Reliability Standards

Contract Amendment No. 4 (which was signed in June 2004) required specific changes in the Massachusetts I&M program that were designed to deal with equipment reliability issues that had been identified through audits in 2002 and 2003. To meet the Amendment’s reliability requirements, Applus found it necessary to replace all equipment supplied by one of the program’s two equipment vendors. The replacement

was completed in February 2005. 2007 was the second complete calendar year in which the program functioned with the upgraded equipment.

Contract Amendment No. 4 also established specific equipment reliability standards, which required the program contractor to significantly increase its maintenance and monitoring of workstations and to provide early identification of needed adjustments and repairs. These standards ensure that the test equipment works reliably enough to consistently identify vehicles with emission systems in need of repair. The standards are used to determine whether the equipment is working at a sufficiently high level of reliability:

- Equipment components that are critical for accurately measuring vehicle emissions (known as “Tier 1” equipment components) must achieve a 90% reliability rate, based on initial random audits performed by MassDEP or its auditing contractor;<sup>9</sup>
- Other, less critical equipment components (known as “Tier 2” equipment components) must achieve an 85% reliability rate, based on initial random audits performed by MassDEP or its auditing contractor; and
- Critical components that are repaired after failing any audit must achieve a 95% reliability rate based on follow-up audits performed by MassDEP or its auditing contractor. (This contract requirement is known as the “Tier 1 reliability standard for follow-up audits.”)

To ensure that these reliability standards are met, Applus agreed to:

- Audit each inspection station quarterly to identify equipment that needed to be repaired;
- Increase its maintenance and monitoring of workstations as well as other Quality Control measures that identify degrading equipment before it fails an audit; and
- Automatically lock workstations out of the computer network when it fails periodic self-checks so it cannot be used until repaired.

An additional contract amendment (No. 6, signed by the Agencies and Applus on May 30, 2006) extended the contract through September 30, 2008, and augmented the reliability standards described above by requiring the contractor on an on-going basis to:

- Improve its response time to requests from inspection stations for workstation repairs,
- Meet performance standards for workstation maintenance and repairs identified by digital and MassDEP audits;
- Upgrade workstation software to correct gas bench response times and VMAS flow adjustments,
- Reformat the Vehicle Inspection Report and implement a communications plan to encourage motorists to use a Registered Repairer for emission control system repairs,

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<sup>9</sup> Initial Random Audits are randomly selected using a protocol agreed to by MassDEP and Applus. MassDEP conducted the first Initial Random Audits pursuant to this protocol in July 2005.

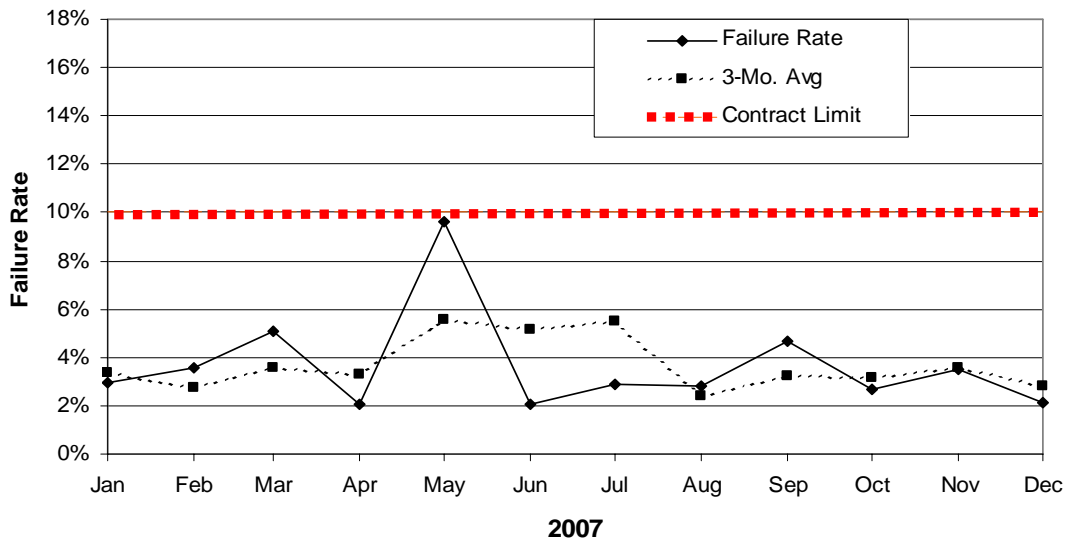
- Update and expand training for emission control repair technicians, and
- Correct the protocol for inspecting heavy-duty vehicles to require that parking brakes are “off” during an inspection.

The contract amendment included schedules for these requirements and performance standards to help ensure that the program contractor meets the requirements throughout the remaining term of the extended contract.

As a direct result of improvements in equipment service and maintenance made throughout 2006 and 2007, Applus achieved the equipment reliability standards established in Contract Amendment No. 4 in 2007.

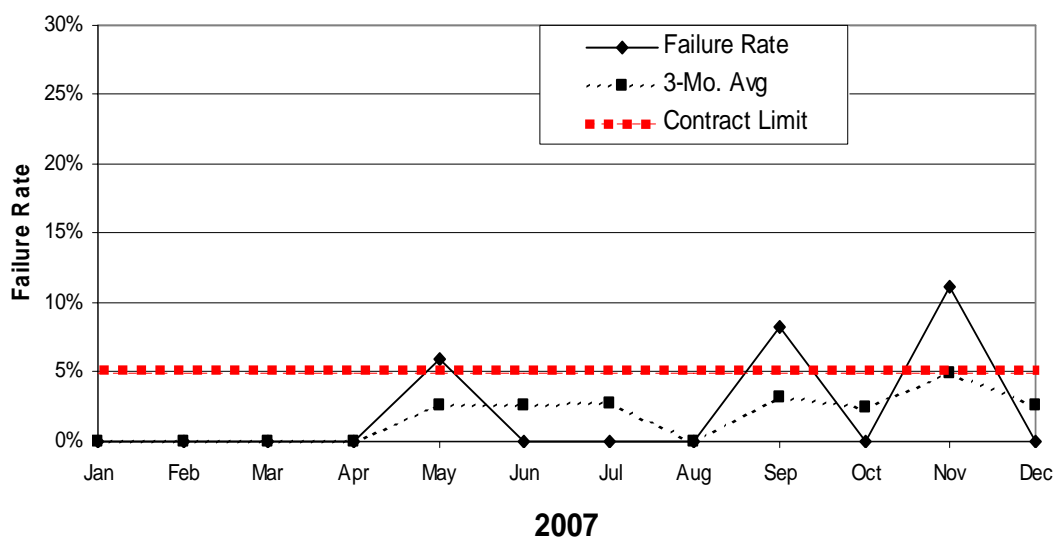
The Tier 1 reliability standard focuses on four audit criteria (combined critical bench and VMAS, gas cap tester, weather station barometric pressure, and OBDII test system), and requires that their failure rates do not exceed 10% for initial random audits, measured by averaging failure rates for these items over rolling three-month periods. Figure 3 below plots monthly failure rates for combined bench and VMAS, the rolling three-month average failure rate, and the 90% reliability standard for initial random audits in 2007. The highest monthly failure rate for combined bench and VMAS was 9.6% in May 2007. In 2007, the three-month average failure rate did not exceed the Tier 1 standard of 10%. May 2007 had the highest three-month average failure rate for the year (5.6%).

**Figure 3: Tier 1 Initial Random Audit Failure Rate – Combined Bench & VMAS**



The Tier 1 reliability standard also established a maximum failure rate of 5% for follow-up audits of the four critical items, averaged over rolling three-month periods. Figure 4 below plots the monthly failure rate in 2007 for follow-up audits of the combined bench and VMAS, the rolling three-month average failure rate, and the 95% reliability standard. In 2007, there were only 3 months with any Tier 1 follow-up audit failures: May, September and November. The three-month-average combined bench and VMAS failures for follow-up audits did not exceed 5% in 2007.

**Figure 4: Tier 1 Follow-Up Audit Failure Rate – Combined Bench & VMAS**



The Tier 2 standards require that the three-month failure rate not exceed 15% for two additional but less critical audit criteria during initial random audits:

- First Gas Bench: the first gas bench audit fails, but the second gas bench audit (conducted after calibrating the bench) passes (i.e. the bench audit failure is not a Tier 1 failure) and
- Gas Cap Tester: the gas cap audit fails, but the second gas cap audit passes after recalibration (i.e. the gas cap audit failure is not a Tier 1 failure).

In 2007, the Tier 2 audit results had a uniformly low failure rate: monthly failure rates were usually zero, and were always below 2%. Therefore, in 2007 the failure rates for Tier 2 items met the established performance standards.

#### 4.4 Equipment Audits Performed by the Program Contractor

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Applus performed 7,255 equipment audits in 2007, using performance standards that are comparable to those used by MassDEP and SGS Testcom. Applus has provided MassDEP with data from their equipment audits conducted in 2007. A summary of this data is presented in Table 8.

**Table 8: 2007 Equipment Audit Failure Rates:  
A Comparison of MassDEP and Applus Technologies Audit Results**

<b>Audit Part</b>	<b>2007 MassDEP Failure Rate</b>	<b>2007 Applus Technologies Failure Rate</b>
Visual Inspection	3%	<1%
Gas Analyzer Visual Inspection	4%	14%
Weather Station	20%	NA
Leak Check	<1%	3%
1 <sup>st</sup> Gas Bench Audit	4%	3%
2 <sup>nd</sup> Gas Bench Audit	87%	NA
Gas Cap Tester	<1%	<1%
Inductive RPM Pickup	1%	NA
OBDII RPM Pickup	<1%	NA
OBDII Tester	<1%	NA
VMAS Visual Inspection	2%	2%
VMAS Dilute O2 Sensor	3%	<1%
VMAS SAO Flow	<1%	3%
<b>Overall Audit Result</b>	<b>30%</b>	<b>22%</b>
<b>Combined Gas Bench + VMAS</b>	<b>7%</b>	<b>7%</b>

Table 8 identifies a few areas where MassDEP and Applus equipment audits found different failure rates. This was often due to a few differences in audit procedures:

- Most significantly, workstation components whose condition would result in a failure of a MassDEP audit were replaced or repaired during Applus' equipment audits. The data described in Table 8 identifies Applus audits as "failures" if Applus replaces or repairs a component during the audit even though the condition of the equipment at the end of an Applus audit would pass.
- Since Applus conducted nearly four times as many audits as MassDEP, MassDEP audits often occur shortly after parts have been recently replaced due to an Applus audit failure. For parts that tend to gradually wear out, like many visual audit items, a recent Applus audit would reduce the chance of a failure on the MassDEP audit. This is most likely the reason for the difference in failure rates for visual inspections of gas

analyzers, where 4% of MassDEP audits failed this part, and 14% of Applus's audits failed this part.

- MassDEP audits cover more parts, and therefore, present more opportunities to fail than the audits conducted by Applus. For example, Applus audits do not address the weather station, the inductive RPM pickup, the OBDII RPM pickup, or the OBDII tester, which are all covered by MassDEP's audits . This factor contributed to the difference in overall audit results: 30% of MassDEP audits failed one or more parts, while 22% of Applus's audits failed one or more parts.

## 5 STATION AND INSPECTOR OVERSIGHT

In the Massachusetts I&M Program, overt and covert audits are conducted to assess station and inspector performance. The results of each type of audit in 2007 are described in this section.

### 5.1 Overt Performance Audits

40 CFR 51.366 (b) (2): The number of inspection stations and lanes operating throughout the year:

- (i) Receiving overt performance audits in the year;
- (ii) Not receiving overt performance audits in the year;

The RMV conducts regular site visits/performance audits to determine if the inspectors are correctly performing all tests and the station's physical conditions continue to meet program requirements. RMV typically visits inspection stations quarterly and performs additional visits to follow up on past problems or to investigate stations or inspectors that are suspected of violating regulations based on consumer complaints or data analysis.

Applus (through a subcontractor) maintains records of all inspections in a database to which MassDEP and RMV had access. RMV conducts monthly "digital audits" before visiting stations, to identify areas and stations that may need investigation. A "digital audit" is a query of the database for information that may indicate issues warranting attention during the site visit. Digital audit items include the station's inspection failure rate and vehicle characteristics recorded during the inspection that do not match the vehicle information in the registration database.

The RMV site visits cover a wide range of items including:

- Observing inspectors performing an inspection;
- Examining station and inspector licenses;
- Collecting voided inspection stickers and checking to see that stickers are stored in a secure location;
- Examining the inspection equipment and bay;
- Supplementing the inspector's training; and
- Investigating consumer complaints and/or anomalous digital audit findings.

RMV staff prepares a written report summarizing the results of each inspection. Violations of policies or regulations identified at site visits are forwarded to RMV headquarters for possible enforcement action.

In 2007, RMV conducted 5,781 overt station visits/audits. All 1,408 stations and 1,465 workstations that operated throughout the year received at least one audit in 2007, and most stations received an audit each quarter.

## 5.2 Covert Audits

Covert audits, or “covert performance audits” are under-cover inspections done with vehicles set to fail one or more parts of the emissions test. This section summarizes covert audits performed by Applus. While Registry staff also conduct covert audits as part of their enforcement activities, the results of their covert audits are not included in the following tables.

Stations are selected for covert audits for four reasons, as described in Table 9.

**Table 9: 2007 Covert Audit Selection Criteria**

Selection Criteria	Count of Audits
MassDEP or RMV Request	10
Data Analysis	558
Random Selection	1,083
High Volume	1
<b>TOTAL 2006 COVERT AUDITS</b>	<b>1,652</b>

Some stations received more than one covert audit, as described in Table 10.

**Table 10: 2007 Covert Audits Per Station**

Number of Audits Per Station	Count of Stations
1	503
2	448
3	68
4	11
5	1
<b>Total Number of Stations Audited</b>	<b>1,031</b>
<b>Total Number of 2007 Audits</b>	<b>1,652</b>

### 5.2.1 COVERT AUDITORS AND COVERT VEHICLES

40 CFR 51.366 (b) (8): The total number of covert vehicles available for undercover audits over the year;  
 (b) (9): The number of covert auditors available for undercover audits.

Covert audit vehicles are selected to represent the range of vehicle technology groups (e.g., carbureted and fuel injected vehicles) covered by the program. Ten vehicles were

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used for covert audits in 2007. The types and technologies of these vehicles are described in Table 14, in section 5.2.4 below.

Covert auditors are re-certified on an annual basis to perform covert vehicle and visual audits.

**Table 11: Covert Auditors<sup>10</sup> in 2007**

Number of full time auditors on staff during 2007	5
Total full time auditors employed during 2007	7
Additional personnel trained and certified to perform covert audits	7

### 5.2.2 NUMBER OF COVERT AUDITS CONDUCTED IN 2007

40 CFR 51.366 (b) (2): The number of inspection stations and lanes operating throughout the year: . . .  
(iii) Receiving covert performance audits in the year;  
(iv) Not receiving covert performance audits in the year;

Table 12 summarizes the number of covert audits conducted during 2007 for each type of inspection station.

<sup>10</sup> Though the RMV conducts covert performance audits and covert visual audits as part of their investigations, the RMV auditors are not included in the counts of covert auditors.

**Table 12: Number of Inspection Stations and Covert Audits in 2007**

		2007 # of Stations <sup>11</sup>	2007 Covert Audits		Stations NOT Receiving Covert Audits
			Audited Stations	# Of Audits	
Operating Throughout the Year	Fleet stations	48	0	0	48
	Public stations	1,360	958	1,555	402
	<b>All stations</b>	<b>1,408</b>	<b>958</b>	<b>1,555</b>	<b>450</b>
Operating Part of the Year	Fleet stations	61	0	0	61
	Public Stations	187	73	97	114
	<b>All stations</b>	<b>248</b>	<b>73</b>	<b>97</b>	<b>175</b>
<b>TOTAL</b>		<b>1,656</b>	<b>1,031</b>	<b>1,652</b>	<b>625</b>

Table 13 shows the total number of workstations in the inspection network and the number of workstations that received covert audits. A workstation is counted as “operating throughout the year” if it conducted at least one emissions inspection each month of the year. Since a workstation may have been located at multiple stations, more workstations operated throughout the year than did inspection stations.

Since the inspector is required to drive the vehicle into the inspection bay during a covert audit, the covert auditor has no control over which workstation is used at stations with multiple workstations.

Please note: only public stations can receive covert audits because fleet stations only test vehicles that are part of the company’s fleet, making it impossible for Applus to present a covert (or “undercover”) vehicle for testing. Also, covert audits are not conducted at stations that inspect only diesel-fueled vehicles.

<sup>11</sup> In order to be considered “operating throughout the year” a station must have conducted at least one emissions test during each month of the year.

**Table 13: Number of Workstations and Covert Audits in 2007**

	# of Workstations	Audited Workstations	# Of Audits	Workstations Not Audited
<b>Operating Throughout the Year</b>	1,465	980	1,588	485
<b>Operating Part of the Year</b>	172	45	45	127
<b>TOTAL</b>	<b>1,637</b>	<b>1,025</b>	<b>1,637</b>	<b>612</b>

### 5.2.3 COVERT AUDIT OVERVIEW

A “false pass” on a covert audit is an inspection that passes a vehicle that was set to fail. The covert audit does not indicate whether the cause of a false pass was related to the equipment or the inspector. Follow-up investigations conducted by Applus and the RMV address the cause of any false passes. When RMV staff investigates false passes as part of a site visit, they initiate enforcement actions and/or provide supplementary inspector training on proper test procedures. RMV refers other information about possible emissions equipment problems to MassDEP for follow-up.

Covert vehicles are set to fail in one of two ways:

- set to fail one test type: either the transient test, two-speed idle, or OBD test, or
- set to fail a combination of test types including: the gas cap test in addition to either a transient, two-speed idle, or OBD test.

### 5.2.4 COVERT AUDIT RESULTS BY TYPE OF FAILING EMISSIONS TEST

40 CFR 51.366 (b) (3): The number of covert audits:

- (i) Conducted with the vehicle set to fail per test type;
- (iii) Resulting in a false pass per test type;

Table 14 and Table 15 (below) summarize the results of the covert audits by the type of emissions failure that was implanted in the covert vehicle. Table 14 shows the false passes for transient, TSI, and OBD tests. All audits were conducted with vehicles set to fail one of these emissions test types.

Some audits were conducted with vehicles set to fail a second emissions test: the gas cap test. Table 15 summarizes the number of audits that falsely passed the gas cap test, when the gas cap was set to fail.

Key findings from the emissions tests presented in Table 14 are:

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- 8.1% of all covert audits resulted in false passes for transient, TSI or OBDII emissions tests.
- 71% (95 of 134) of the false passes in Table 14 were caused by inspectors improperly changing the initial test type from transient to TSI (the TSI test does not test for NO<sub>x</sub>). Seventy-six of these improper TSI tests occurred in audits which employed a single audit vehicle with four-wheel drive that can be disengaged.
- Eight covert audits (0.5%) that should have received an emissions test incorrectly received a safety-only test. These eight audits are counted as falsely passing in Table 14.

**Table 14: 2007 Covert Audit Results:  
False Passes for Transient TSI and OBD Tests<sup>12</sup>**

<b>Emissions Test Type Set to Fail</b>	<b>Model Year</b>	<b>Vehicle Type and Technology<sup>13</sup></b>	<b>Specific Failures</b>	<b>Total Audits Passed</b>	<b>Falsely Passed<sup>14</sup></b>	<b>Percent Falsely Passed</b>
Transient	1984 to 1987	LDGV & LDGT	HC and/or CO Failure	12	0	0%
Transient	1988 to 1995	LDGV & LDGT	HC and/or CO Failure	298	7	2.3%
Transient	1988 to 1995	LDGV & LDGT	NOx Failure	883	118 <sup>15</sup>	13.4%
OBDII	1996 and newer+	LDGV & LDGT, OBDII equipped	OBDII Failure	309	1	0.3%
Two-Speed Idle	Any	LDGV, AWD	HC and/or CO Failure	150	8	5.3%
Totals for Audits Transient, TSI or OBD Set to Fail				1.652	134	8.1%

Because all covert audits that are set to fail the gas cap test are also set to fail another type of emissions test (transient, TSI, or OBDII), the false passes for gas cap tests are summarized separately in Table 15 below. The vast majority of covert audit false passes were for the gas cap test, with 70.8% of gas cap audits resulting in a false pass.

<sup>12</sup> The Registry also conducts some covert audits as part of its investigations. Registry audits are not included in the “Covert Audit Results” tables

<sup>13</sup> LDGV: light duty gasoline vehicle; LDGT: light duty gasoline truck; AWD: all wheel drive.

<sup>14</sup> “Falsely passed” includes inspections that passed on the correct type of emissions test, that passed on the incorrect type of emissions test, or that skipped the transient test based on the inspector’s claim there was a safety issue. For the transient tests that were skipped due to safety, a transient test would have been required if the vehicle returned to the station for a re-test.

<sup>15</sup> These false passes include 95 passes for vehicles that were incorrectly given an initial TSI test. The TSI test does not address NOx.

**Table 15: 2007 Covert Audit Results:  
False Passes for Gas Cap Tests**

<b>Emissions Test Type Set to Fail</b>	<b>Model Year</b>	<b>Vehicle Type and Technology</b>	<b>Specific Failures</b>	<b>Total Audits</b>	<b>Falsely Passed<sup>16</sup></b>	<b>Percent Falsely Passed</b>
Gas Cap	Any	Any	Gas Cap Functional Failure	633	448	70.8%

See section 5.2.5 for a brief discussion of this failure rate.

**5.2.5 COVERT AUDIT RESULTS OF VEHICLES SET TO FAIL A COMBINATION OF TEST TYPES**

40 CFR 51.366 (b) (3): The number of covert audits:

- (ii) Conducted with the vehicle set to fail any combination of two or more test types;
- (iv) Resulting in a false pass for any combination of two or more test types;

Table 16 below summarizes the false passes for covert vehicles, by the number of emissions tests the vehicles were set to fail. Covert audits conducted with vehicles set to fail two types of emissions tests used a combination of test types including the gas cap test and one of the other three emissions tests: transient, TSI, and OBD II. 70.89% of these covert audits falsely passed one or more item.

As can be seen in Table 16, 33.8% of all covert audits resulted in false passes for one or more test type. Falsely passing gas caps constituted 27.1% of all covert audits (448 of 1,652).

**Table 16: 2007 Covert Audit Results:  
By Number of Emissions Tests Set to Fail**

<b>Covert Audit Results by Vehicle Test Type</b>	<b>Total Audits</b>	<b>Falsely Passed 1 or More Test Type</b>	<b>Percent Falsely Passed 1 or More Test Type</b>
Totals for Audits with Only One Type of Emissions Test Set to Fail	1,019	110	10.8%
Totals for Audits with Two Types of Emissions Tests Set to Fail	633	449	70.9%
Totals for All Audits	1,652	559	33.8%

<sup>16</sup> “Falsely passed” includes inspections that passed the functional gas cap test, that incorrectly indicated that a gas cap adaptor was not available, or that did not test the gas cap because of improperly providing a safety only test.

While the percentage of false passes may appear to be high, more than 30% of all covert audits were prompted by suspected problems at stations. Therefore, the expected percentage of false passes for the fleet as a whole may be lower than the false-pass rate for covert audits.

Of the covert audit vehicles that had two audit criteria set to "fail", many were OBD-equipped. Since the OBD test checks the entire vapor control system, the inspectors who falsely passed these vehicles may not have understood that the gas cap test remains part of the inspection protocol, and therefore may have skipped this test element. Because more than three-quarters of initial emissions inspections in Massachusetts are OBD tests, and because the OBD system performs a more comprehensive check of vapor controls than the gas cap-only test that is also used for testing non-OBD equipped vehicles, Massachusetts will phase out the gas cap test when the program transitions to an OBD-only emissions test (starting in October 2008).

When a covert audit identified a false passing test, the result was made available to RMV for more in-depth investigation and possible enforcement action against the station and/or the inspector. Enforcement actions are described in Section 5.2.6 below.

#### 5.2.6 STATION AND INSPECTOR HEARING RESULTS

40 CFR 51.366 (b) (6): The number of hearings:

- (i) Held to consider adverse actions against inspectors and stations; and
- (ii) Resulting in adverse actions against inspectors and stations;

40 CFR 51.366 (b) (4): The number of inspectors and stations:

- (i) That were suspended, fired, or otherwise prohibited from testing as a result of covert audits;
- (ii) That were suspended, fired, or otherwise prohibited from testing for other causes; and

40 CFR 51.366 (b) (2): The number of inspection stations and lanes operating throughout the year: . . .

- (v) That have been shut down as a result of overt performance audits;

Table 17 summarizes the results of the Registry's hearings for stations and inspectors, and tabulates the written violations issued to stations and inspectors. This table describes all written violations ("adverse actions") that were issued in 2007, including those for which hearings were not requested, those for which hearings were held, and those for which the hearing result was appealed to the Registry's Board of Appeals. Data indicating which of these actions resulted from covert audits versus other performance assessments is not available.

**Table 17: 2007 Audit and Enforcement Statistics**

	Number of Enforcement Actions	
<b>Stations</b>		
Total Number of Written Violations	488	
Warning Letters (no hearing)		85
Violations Filed (no action or hearing)		6
Total Number of Hearings	393	
Revoke		5
Suspensions		242
Warnings		119
Other (abeyance, surveillance)		5
No action		22
Unresolved Cases	4	
(As of 12/31/2007)		
<b>Inspectors</b>		
Total Number of Written Violations	473	
Warning Letters (no hearing)		67
Violations Filed (no action or hearing)		4
Total Number of Hearings	397	
Revoke		27
Suspensions		140
Suspension Pending		
Retraining		36
Warnings		174
Other(abeyance, surveillance)		3
No Action		17
Unresolved Cases	5	
(As of 12/31/2007)		

5.2.7 FINES COLLECTED

## 2007 Annual Report: Massachusetts

40 CFR 51.366 (b) (4): The number of inspectors and stations: . . . (iii) That received fines;  
40 CFR 51.366 (b) (7): The total amount collected in fines from inspectors and stations by type of violation;

Massachusetts does not collect fines from stations or inspectors.

### 5.2.8 STATION COMPLIANCE DOCUMENTS - ISSUED AND MISSING DOCUMENTS

40 CFR 51.366 (d) (1) (iii): The total number of compliance documents issued to inspection stations;  
(iv) The number of missing compliance documents;

Stations were issued 4,956,566 stickers in 2007. A total of 52 stickers were “unaccounted for” by the contractor. Those “unaccounted for” stickers include stickers that were damaged, misprinted, or were otherwise defective, as well as damaged stickers that were picked up by the RMV on site visits. In addition to the 220 unaccounted for stickers, the stations noted in the database that another 76 stickers were stolen. Of these, 71 were reported by one station and were later determined to have been listed as “stolen” in error. An additional five shipments of stickers, totaling 3,300 stickers, were lost when shipped. Police reports were filed for these five shipments.

## 6 EMISSIONS TEST RESULTS

### 6.1 Emissions Tests and the Massachusetts Fleet

Of the 1,899,718 unique gasoline-fueled vehicles that received an initial emissions test during 2007, 177,272 (8.6%) failed their initial test. Of the 43,020 unique diesel-fueled vehicles that received an initial emissions test in 2007, 415 or (1.0%) failed their initial test. The Massachusetts program requires that vehicles be repaired and re-tested within 60 days of failing a test.

Table 18 summarizes the failure rates for initial emissions tests in Massachusetts in 2007:

**Table 18: 2007 Failure Rate for Initial Emissions Tests**

	Initial Emissions Failure Rate <sup>17</sup>		
	Model Years 1984-1995	Model Years 1996 and newer	Total
Gasoline-Fueled Vehicles	11.0%	8.7%	9.1%
Diesel fueled	2.6%	0.4%	1.0%
All Initial Emissions Tests	10.7%	8.5%	8.9%

Please note:

- Ninety-two percent of the vehicles that failed their initial emissions test passed a re-test (presumably after repairing the problem that caused them to fail the initial test).
- A very few vehicles were repaired but were still not able to pass a re-test, and were granted a waiver of the emission requirements. In 2007, waivers were granted for 184 vehicles (or less than 0.1% of the vehicles that failed their initial emissions test).
- Of the vehicles that failed their initial test during 2007, 33,023 (or 18.6%) had neither passed a re-test nor obtained a waiver by March 31, 2008.

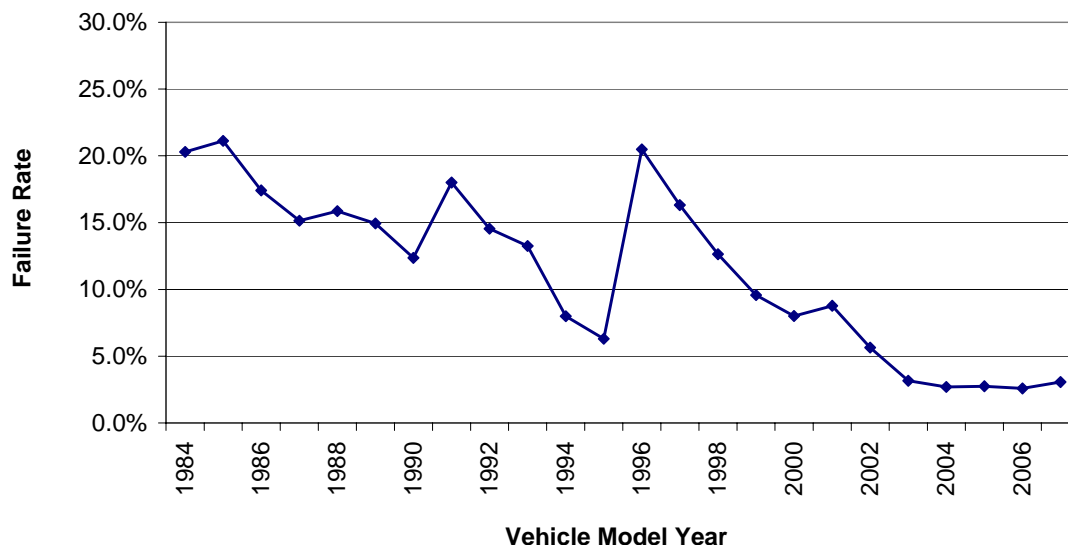
Massachusetts started OBD II “Pass Fail” testing on June 15, 2004, for 1996 and newer OBD-equipped vehicles. For the OBDII test, the inspector downloads data from the vehicle’s computer regarding its emission control system and those data are used to determine the emission test result. Ninety-two percent of the vehicles that failed their initial emissions test passed a re-test (presumably after repairing the problem that caused them to fail the initial test).

- Details of all 2007 emissions test results are included in Attachment C.

<sup>17</sup> The emissions failure rates only consider OBD and tailpipe results, and do not take into account visual or gas cap failures.

Figure 5 below shows 2007 emissions failure rates by model year for gasoline-fueled vehicles. As can be seen, the age of the vehicle has a significant impact on failure rate. The Massachusetts I&M program is not designed to achieve a specific overall failure rate or a specific failure rate for any particular test or type of vehicle.

**Figure 5: 2007 Failure Rate by Model Year – Non-Diesel Initial Emissions Tests**



## 6.2 Emission Reductions from Repaired Transient-Tested Vehicles in 2007

40 CFR 51.366 (a) (5): The average increase or decrease in tailpipe emission levels for HC, CO, and NOx (if applicable) after repairs by model year and vehicle type for vehicles receiving a mass emissions test.

EPA requires states to calculate emission reductions from vehicles that are repaired after failing a “transient” emissions test<sup>18</sup>. Of the 33,521 vehicles that failed an initial transient test in 2007, 24,094 vehicles were successfully repaired and passed a subsequent transient test. Based on an examination of the emissions data for the initial failing transient test and the emissions data for the subsequent passing transient retests, these repairs were estimated to have reduced the emissions of those vehicles by an average of 73% for hydrocarbons, 80% for carbon monoxide and 60% for oxides of nitrogen.

Section 5 of Attachment C describes the average change in emissions measured by the transient test after repairs, by model year and vehicle type.

<sup>18</sup> One of the three types of emissions tests used in Massachusetts, which measures specific pollutants in tailpipe exhaust from gasoline-fueled vehicles

### **6.3 Overall Conclusions about Program Operation During 2007**

Several conclusions can be drawn from the program information reviewed for the 2007 Annual Report:

- Equipment audits indicate that the performance of the testing equipment has improved markedly over the last four years. The contractor consistently met the three reliability standards established by Contract Amendment No. 4 during 2007, and audit failure rate for almost all criteria are well below contractual levels.
- Most vehicles that fail an initial emissions test are repaired successfully and pass a re-test, with significant improvements in emissions. The program continues to issue a very small number of waivers of the emission standards (184 in 2007), far below the commitment in Massachusetts' I&M SIP of limiting waivers to no more than 1% of vehicles that fail an initial emissions test.
- The portion of the initial emissions tests that use OBD II has continued to grow (from 77.7% in 2006 to 78.8% in 2007). OBD testing provides better oversight of vehicle emission systems and identifies many problems before they become significant sources of emissions.

# Attachment A: Index of Report Pages Relevant to EPA Regulation Sections

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Massachusetts Enhanced Emissions and Safety Test  
Inspection and Maintenance Program

Attachment A: Index of Report Pages Relevant to EPA Regulation Sections

**Rules**

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# Attachment B: RMV Re-test Reminder Letter

Massachusetts Enhanced Emissions and Safety Test  
Inspection and Maintenance Program

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[Registry of Motor Vehicles Letterhead]

Dear Motorist:

RMV records indicate that as of [DATE] your [VEHICLE] may not be displaying a valid inspection sticker. Your vehicle must pass a reinspection by [DATE].

This letter serves as a reminder that vehicles with safety-related defects must be repaired immediately. Not only is it unsafe for you and others on the road, but you could be cited by law enforcement if you drive your vehicle with a safety defect.

Emission repairs should be performed as soon as possible. We recommend you bring your vehicle to a state registered repair shop. If you have a 1996 or newer model year vehicle, you may need to drive your vehicle for about a week of combined city and highway driving to reset its on-board computer and to be ready for a reinspection.

All vehicles that fail for safety and emissions are required to pass a reinspection within 60 days.

If your vehicle has passed inspection since [DATE] and now has a valid inspection sticker, congratulations and thank you for doing your part. You may disregard this notice. No further action is required.

If you have questions or need to find a registered emissions repair shop, please call the toll-free Motorist Hotline at (877) 387-8234 or visit [www.mass.gov/vehicletest](http://www.mass.gov/vehicletest) for more information regarding the vehicle inspection program.

Thanks for your attention, and drive safely and cleanly!

Sincerely,

Rachel Kaprielian  
Registrar

## Attachment C: Detailed 2007 Emissions Test Data

## Attachment D: 2007 Test Data by Station

Massachusetts Enhanced Emissions and Safety Test  
Inspection and Maintenance Program

*Please note: Attachments C and D have been provided to EPA on a  
compact disc.*

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