

## **SUBSTANTIVE POLICY STATEMENT**

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### Quality Assurance Operational Procedure

#### State Station Audit Procedure

A. Scope:

This procedure outlines the equipment and methods for conducting performance audit at official state vehicle emission inspection stations. Covered are gaseous emissions analyzers, diesel smoke opacity meters and chassis dynamometers.

B. Applicability:

The Quality Assurance Unit is responsible for auditing all state station operational inspection lane gaseous analyzers and opacity meters a minimum of twice monthly and chassis dynamometers at least once in each quarter. The audit process will assure that all inspection instrumentation operates in accordance with prescribed specifications and tolerances.

C. Procedures:

The procedures are presented in three parts. The gaseous analyzer audit procedure is presented in Part 1.0, Part 2.0 covers the opacity meter audit procedure, and chassis dynamometers are covered in Part 3.0.

#### Part 1.0      **GASEOUS EMISSIONS ANALYZER AUDIT PROCEDURE**

##### 1.1 GENERAL DESCRIPTION

The audit consists of supplying various known concentrations of hydrocarbon (HC), carbon monoxide (CO), and carbon dioxide (CO<sub>2</sub>) gases to the state station emission analyzer probe via a simulated tail pipe adapter (STP). The procedure is performed by entering a dedicated audit mode. The audit function simplifies the process by automating the data gathering, calculation of variance and final status. Audit results are consolidated in a special audit file which allows compilation of monthly audit reports.

The system samples the supplied gas, analyzes the concentrations of the pollutants, **and records them in the computers database.** The audit report identifies the station and lane being audited as well as the audit date, time, and type of audit. Detailed on the audit gas HC, Co and CO2 concentrations, allowable tolerances, analyzer readings differences, and the pass/ fail status for each pollutant.

## 1.2 Equipment required

1. Simulated tail pipe adapter (stp adapter)
2. **Cylinders (2) of audit gas**  
ADEQ gas blends
3. State Station Audit Report forms

## 1.3 Preparation

When the State Inspector arrives at the station he/she will meet with the manager or assistant and advise of the purpose of the visit. The inspector will then proceed with the audits as follows.

Once a lane has been made available for audit by management, the inspector shall proceed with the audit. The Gordon-Darby automated audit inspection system is very user friendly. The various functions --test modes, calibration, auditing and others are invoked via menu selections and the operator is guided through the process by numerous screen prompts. The inspector simply reads the messages and follows the prompts to complete the audit. The audit process will be initiated at the Position 2 (lane exit) data entry terminal.

From the Main Menu the inspector will select Logon/logoff by pressing first character of the desired selection. In this case press the "L" key for logon/logoff.

A new screen will appear. Enter the four digit user code ( usually the last four digits of your social security number) on the keyboard and press enter.

The Main Menu will reappear. Select **Cal/Audit Procedure ( "A" Key)** on the keypad and then press enter. The **Audit and Calibration menu** window will be displayed. Select **"Audit" ("A" key)** and press enter. The **Audit Menu** window will then be displayed. Select **"Triblend Gas" ("G" Key)** and press enter. The **"Gas Audit" Menu window** will be displayed. Enter the letter **"H"** (for Hexane) press enter. The cursor will advance to the next entry point. Enter the **HC** concentration values of the first audit gas, press enter. The cursor will advance to the next entry point. Enter the **CO** gas concentration values, press enter. The cursor again will advance to the next entry. Enter **CO2** gas

concentration values, press enter. The cursor will advance to the entry of “Allowable Deviations”. Enter the **HC** allowable deviation, press enter. Enter the **CO** allowable deviation, press enter. Enter the **CO2** allowable deviation, press enter. The system will then self zero when complete, “**Insert Probe**” will appear on the monitor.

The actual values to be entered will be obtained from the VEI analysis labeling. Each cylinder of audit gas under goes a quality control check which analyzes the Concentrations (gas naming) of each component. Each acceptable cylinder will be labeled with the analyzed concentration values of each component and the date of analysis.

The lane analyzer must read each component within perscribed tolerances which may vary according to the type of component and its range. A gas analytical tolerance of plus or minus two percent of the gas value is also added. The analyzer tolerances are as follows:

COMPONENT TYPE	RANGE	ACCURACY
HC	0-500 ppm Hexane	+/- 15 ppmH
	501-2000ppmH	+/- 50 ppmH
HHC	0-25,000 ppm Propane	+/- 1250 ppmP
CO	0-2.0 Mol %	+/- 0.10 Mol %
	2.01 - 10.0 Mol %	+/- 0.25 Mol %
CO2	0 - 20 Mol %	+/- 1.2 Mol %

The final pass/fail limits or allowable deviations are determined by adding the gas tolerance to the analyzer tolerance. An example of the calculation necessary to determine the final tolerance and the pass/fail limits is provided below.

Audit gas analyzed value:		300 ppm
Gas analysis tolerance	(+/-2.0%)	+/- 6 ppm
Analyzer tolerance:		+/- 15 ppm
Combined tolerance:		+/- 21 ppm
Final pass/fail limit:		279 - 321 ppm

The ALLOWABLE Deviation for each component of the standard audit gases, based on the various gas values, analyzer tolerance by range, and gas tolerances are listed below:

Component Type	Gas Value	Allowable Deviation
HC	300 ppmH	21 ppm
	800 ppmH	66 ppm
CO	1.5 Mol %	0.13 %
	6.0 Mol %	0.37 %

CO2

5.2 Mol %

1.2 % \*

\* A gas tolerance is **not applied to CO2** or extended hydrocarbon (HHC) gases. Analyzer tolerance alone is entered as the allowable deviation.

When the inspector has complete entry of the gas values and allowable tolerance the final entries **MUST** be checked for the proper entry. Observe cursor position when keying in the values to avoid errors such as entering a CO2 value of 50.2 % when the actual value is 05.2 %. Each field must be properly filled or such error will result. If any incorrect entries have been made, they **must be corrected** before proceeding. Failure to review and correct may result in a Failing Audit when the unit actually passed.

If such invalid audit reports are noted and sent to file , the inspector will make a notation on the State Station Audit Report. If the lane actually passed (read within tolerance), but A failure was noted, the final status will be altered to reflect a **Pass**. The notation will accurately reflect any and all errors and final status. All completed audits or those aborted due to a system error will be recorded on the State Station Audit form.

#### 1.4 Audit Procedure

After accurate data entry has been verified, the inspector will ensure that the audit gas supply and apparatus are ready for use.

Step 1. Ensure that the correct gas (matching the values entered above) is connected to the STP; that the gas cylinder shut off valve has been turned on; and the cylinder regulator is adjusted for an output pressure of **20 to 30 PSIG**.

Step 2. When the apparatus is ready, the inspector will press enter to execute the gas audit. The system will prompt the inspector to insert probe and the analyzer will begin sampling.

Step 3. At the prompt insert the STP connection in the correct gas cylinder outlet, this will start the flow of gas into the analyzer.

Step 4. While sampling, ensure that the STP pressure gauge reads between 3 to 6 inches of water. Normal setting is 5 inches. Adequate gas supply is also evidenced by the STP ballon. Inflation to the point where the ballon just stands up indicates proper, adequate flow. If the above conditions are not met, quickly remove the probe to abort audit ( low CO2) and identify cause of low flow. Correct before restarting the process.

Step 5. A message detailing audit completion will be displayed, at the prompt Disconnect STP from gas cylinder gauges and remove probe.

Step 6. The Gas Audit screen will reappear and Actual Readings and Deviation will be displayed in the appropriate area. **Do Not Press Enter**, copy these readings onto the State Station Audit Report at this time. If enter was pressed before the results could be copied onto the Audit report the analyzer readings would be sent to file without any results being documented.

Step 7. The inspector will review the audit report to determine the pass/fail status. If the analyzer/system is out of tolerance (fail), the inspector will repeat the audit beginning at the Part 1.3 PREPERATION with the same gas. For a final fail status the lane must fail two back to back audits.

Step 8. The complete process from Part 3.3 PREPERATION must be complete for each audit gas to be run during the audit. Normally only two gas blends will be run during a routine audit. Prior to beginning each audit cycle any additional gases or special gases to be run will be identified by the Quality Assurance Manager.

Step 9. The inspector will **immediately notify** the QA manager by telephone when ever a lane FAIL Audit or when an unusual event, prevents completion of the audit

Step 10. Complete a Notice of Station Lane Failure report for each lane failing audit. In the codefield enter the particular analyzer type rather than the code number. Asan example enter HC when an hydrocarbon analyzer fails rather than entering a code 1 for HC/CO. The top page of the two part form will be presented to the station managment

## 1.5 Reporting

Following completion of all lane audits, the inspector will have completed a State Station Audit Report - Gas form to summarize and consolidate lane results in a convenient format. This is a simple process of transcribing data from each lane audit to the report form. The entries ( lane audits ) must be in numerical order from top to bottom. The form allows entry of five lane audits.

Enter the audits, high gas first and multiple runs in order in which they were run. Include any explanatory nototions as described in final paragraph of Part 1.3. Ensure that the rewport heading and body are complete. Correct any omissions and have station managment sign in the RECIEVED BY: area. Once signed remove original and present to station management.

## 2.0 Opacity Meter Audit Procedure

### 2.1 General Description

The audit consists of inserting an optical filter of known value into the opacity meter detector while the system performs a diesel opacity test or an opacity audit. The system reads the opacity value of the filter and sends the information to file. The values must be within the accuracy limits established in the procedure. If the criteria is met, the system is operating properly and the audit is complete. Conversely if the system exceeds the limits the lane fails.

## 2.2 Equipment Required

1. Optical filter assembly - A neutral density filter or known and certified value with a tolerance of no more than
2. Optical filter guide - A device which ensures that the optical filter is always positioned in the opacity meter detector in the same way.
3. State Station audit Report forms.
4. Notice of Station Failure forms.

## 2.3 Preperation

When the State Inspector arrives at the station, he/she will meet with the manager or assistant and advise of the purpose of the visit. The inspector will then proceed with the audit as follows.

Once a lane has been made available for audit by management, the inspector shall proceed with the audit. The Gordon-darby automated inspection system is very user friendly. The various functions -- test modes, calibration, auditing and others are invoked via menu selections and the operator is guided through the process by screen prompts. The inspector simply reads the messages and follows the prompts to complete an audit. The audit process will be initiated at the Position 2 (lane exit) data entry terminal.

From the main menu the inspector will select Logon/Logoff by pressing the first character of the desired selection, in this case press the "L" key for logon/logoff.

A new screen will appear. Enter your four digit user code on the key board and press enter.

The Main Menu will reappear. Select **Audit Procedures** and press enter. The Audit menu will be displayed. Select Opacity Audit ("O" key) and press enter.

The Opacity entry screen will appear. The inspector will enter the opacity value of the audit filter to be used. Normally a nominal 20% filter is used for routine audits. Instruction for the use of different or additional filters will be given prior to initiation of the audit cycle. Allowable deviation of five (5%) must be entered.

When the inspector has completed entry of the filter value and five (5%) allowable deviation the entries **MUST** be checked for accuracy. Failure to review and correct may result in a failing audit report being printed when the unit actually passed.

If such invalid audit report is sent to file, the inspector will make notation on the Opacity Audit Report detailing the incorrect entry. If the lane actually passed (read within tolerance), but a failure was noted, the final status will be altered to reflect a **Pass**. The notation will accurately reflect any and all errors and final status. All completed audits or those aborted due to a system error will be recorded on the **State Station Audit Report** form.

## 2.4 AUDIT PROCEDURE

After the accurate data entry has been verified, the inspector will then press enter to initiate the opacity audit.

Step 1. A screen message will prompt the inspector to CLEAR PATH, PRESS START. Ensure that the light path is unobstructed and depress and momentarily hold ( few seconds) the start button or the trigger.

Step 2. The Inspector will be prompted to BLOCK PATH, PRESS START. The inspector will then block the light path with a total opaque object: hand or finger, (*let meter box stabilize at 100%*) and while blocked depress and Momentarily hold the start button or trigger.

Step 3. The inspector will then insert the filter guide into the detector and ensure that it is properly positioned.

Step 4. The System will prompt INSERT FILTER, PRESS START. The inspector or will then insert the filter assembly into the filter guide and index to the desired filter. Once positioned the inspector will depress the start button or trigger and momentarily hold.

Step 5. A message detailing audit completion will be displayed. At the prompt remove filter and guide from the detector.

Step 6. The Opacity Audit screen will appear and the Opacity Reading and Actual Deviation % will be displayed. Enter readings onto State Station Audit report before pressing enter. When enter is pressed the audit report will be sent to file.

Step 7. The inspector will review the audit report to determine the pass / fail status. If the opacity measurement system is out of tolerance (fail), the inspector will repeat the audit beginning at Part 1.3 PREPERATION with the same filter. For a final fail status the lane must fail back to back audits.

Step 8. The complete process from Part 2.3 PREPARATION must be complete for each opacity meter / lane to be run during the station audit.

Step 9. The inspector will **immediately notify** the QA manager by telephone when ever a lane FAILS AUDIT or when an unusual event, prevent completion of the audit.

Step 10. Complete a NOTICE OF STATE LANE FAILURE report for each lane failing audit. The original copy of the two part form will be presented to the station management.

## 2.5 REPORTING

Following completion of all lane audits, the inspector will complete a State Station Audit Report - Diesel form to summarize and consolidate lane results in a convenient format. This is a simple process of transcribing data from each lane to the report form. The entries ( lane audits) must be in numerical order from top to bottom. The form allows entry of five lane audits. Ensure that the reports heading and body are complete. Correct any omissions and have the station managment sign in the RECIEVED BY: area. Once signed remove the original and present to station management. Fasten all yellow copys and **Secure**.

## 3.0 Chassis Dynamometer Audit Procedure

### 3.1 General Description

Two elements of the chassic dynamometer operation are routinely audited. The accuracy of the load measurement and speed measurement are checked. The load audit consists of placing a known weight on the dyno's torque arm and comparing the resultant measurement to the actual weight.

The speed audit consists of operating the dynamometer at a steady speed utilizing a vehicle to power the dynamometer rolls and measuring the actual roll speed with the optical tachometer. Actual roll speed is then compared to indicated speed and the differences calculated.

### 3.2 Equipment Required

- 1 Optical tachometer ( 50 - 20,000 rpm +/- 1 rpm ) ( Phasar Tach, Monarch

Instrument)

2. Reflective Tape (Roll) & Scissors
3. State Station Dynamometer Audit report
4. Notice of State Lane Failure report

Note: Prior to performing an audit, the optical tachometer batteries will be charged at least 12 hours or fresh fully-charged batteries will be installed.

### 3.3 Preparation

When the State Inspector arrives at the station, he/she will meet with the manager or assistant and advise of the purpose of the visit. The inspector will then proceed with the audits as follows.