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SOUTHWEST RESEARCH INST SAN ANTONIO TX MOBILE ENERGY DIV F/G 13/6
ARMY PILOT EMISSION MONITORING PROGRAM AND UPDATING OF STATE EM--ETC(U)
APR 79 J D TOSH, J A RUSSELL
DAAE07-77-C-4625

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report covers a one-year program of periodic exhaust emission tests on a fleet of 286 commercial design, light-duty, military vehicles and 84 light-duty tactical (M151 and M880) vehicles. The program was conducted at three U.S. Army installations (Ft. Sam Houston, TX; Pine Bluff Arsenal, AR; and Ft. Lewis, WA) by Southwest Research Institute, San Antonio, TX.		

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20. ABSTRACT (Cont'd)

Vehicles at each installation were divided into two groups (Test and Control), and commercially available exhaust emission analyzers were then used to check carbon monoxide and unburned hydrocarbon emissions. Vehicles in the Control groups were checked, but no adjustments were made--whereas those vehicles in the test groups were adjusted after measurements to the lowest possible unburned hydrocarbon and carbon monoxide level. Generally, this method of adjustment resulted in dramatic reduction in carbon monoxide and unburned hydrocarbons for both tactical and nontactical vehicles as well as fuel economy increases for nontactical vehicles.

FOREWORD

This project was initiated in September 1977 by the Maintenance Directorate, U.S. Army Tank-Automotive Materiel Readiness Command (TARCOM), Warren, Michigan. The engineering effort on which this report is based was provided by the Mobile Energy Division, Southwest Research Institute (SwRI), 6220 Culebra Road, San Antonio, TX, under Contract No. DAAE07-77-C-4625 and Modification No. P00001. The U.S. Army Fuels and Lubricants Research Laboratory was utilized on a limited basis with the concurrence of the U.S. Army Mobility Equipment Research and Development Command (MERADCOM) on a noninterference basis with other MERADCOM projects. The Contracting Officer's Technical Representative for this program was CW3 Leon Talley, USATARCOM.

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I. INTRODUCTION

A. Background

Beginning with the Clean Air Act of 1970, followed by Executive Order 11507 in 1971 (Federal agencies to provide leadership in environmental clean-up programs), U.S. Army Tank-Automotive Materiel Readiness Command (TARCOM) environmental control activities have steadily increased, resulting in several significant contributions to the overall national effort. As the time approaches for the various states to enforce engine exhaust emissions standards, the need for a military exhaust emissions analyzer becomes important. The military community is committed to maintain its vehicles in such operating condition that these vehicles do not violate the standards set forth in the Clean Air Act of 1970 unless the changes caused by this commitment would reduce the overall combat mission capability of the vehicle.

Previous TARCOM environmental programs conducted by U.S. Army Fuels and Lubricants Research Laboratory (AFLRL) entailed (a) development of a summary manual which condenses and interprets Federal, state, and municipal standards, vehicle noise limits, and vehicle inspection and maintenance, and (b) test method development and practical evaluation, rating and ranking of principal commercial exhaust emission analyzer equipment in terms of TARCOM field utilization.

B. Objective

One objective of the program described in this report was to continue to update the summary manual to provide current knowledge of local and national vehicle inspection and maintenance requirements. A second objective was to conduct a field evaluation program to provide a quantitative definition of both compliance of TARCOM-controlled components/equipment with such requirements and to determine the possible identification of cost effectiveness resulting from diagnostic analysis with exhaust emission analyzers in field operating environments.

C. Approach

A one-year field evaluation program was conducted to demonstrate the possible improvements in exhaust emissions, maintenance, and fuel economy which can be realized from the diagnostic application of exhaust emissions analyzers. The program was to provide data on fuel consumption, frequency of maintenance, types of maintenance, stability of emissions levels and effectiveness of emissions analyzers on a variety of military vehicles.

For this field evaluation, three military installations were selected by TARCOM. The criteria for site selection included geographic location, size and type of fleet available, the maintenance capability of the post, and the willingness of the post commander to participate in the program.

At each post, the fleets were divided into two groups: test and control. Vehicles for each group were selected based on age, mileage, and utilization in order to provide (as closely as possible) balanced groups for valid post-program comparisons. The baseline (control) groups were monitored with the emissions analyzers, but only standard routine maintenance was performed. The vehicles in the test groups were adjusted for lowest HC/CO levels, and maintenance was then recommended based on the results of the emissions tests. All emission results were recorded, along with fuel consumption data and the maintenance action taken.

II. TASK I--EMISSIONS EVALUATION

A. Test Sites and Fleets

The three military installations selected for the field study were Ft. Sam Houston, TX; Ft. Lewis, WA; and Pine Bluff, AR. One of the installations (Ft. Lewis, WA) had tactical vehicles assigned; therefore, M151 and M880 vehicles were included in the program, although not required by the contract.

A breakdown of vehicles at each participating installation is shown in Table 1.

TABLE 1. NUMBER OF VEHICLES UTILIZED
BY INSTALLATION

<u>Installation</u>	<u>Sedan/Sta Wgn</u>	<u>Pickup/Van</u>	<u>Tactical</u>
Ft. Sam Houston, TX	52	76	--
Ft. Lewis, AR	20	47	84
Pine Bluff, WA	14	77	--

Additional information, such as year, make, model, etc., on all vehicles utilized in the program is presented in subsequent tables.

B. Test Equipment--Analyzers

Following a program (Contract No. DAAK02-73-C-0221) in which ten different exhaust emissions analyzers were field tested for durability and performance quality, seven emission analyzers were shipped to AFLRL by TARCOM in anticipation of a continuing program to evaluate the analyzer as a diagnostic tool. Table 2 provides information on the seven analyzers utilized in this program. Of the instruments, six were placed at the three selected sites, and one was retained at AFLRL for calibration of the other units if necessary.

Before shipping to the respective test sites, each instrument underwent a thorough checkout and calibration procedure. After calibration, all units were completely tested, cleaned, and packed for shipment. The calibration of the instruments were then checked against each other at each site prior to initial use and also prior to each periodic emission check. If a discrepancy in calibration between the two units had existed, the calibrated analyzer retained at AFLRL would have been used to check the calibration of the instruments "on site." After initial setup and calibration, the instruments were then alternated as "prime instrument" for each of the periodic checks throughout the program.

C. Vehicle Adjustment Procedure

1. Test Vehicles

For each of the periodic checks, the test vehicles were operated until the engine was up to normal operating temperature. The vehicle was then driven to

TABLE 2. EXHAUST EMISSION ANALYZER DATA AND LOCATION ASSIGNED

Manufacturer	Unit Description	Meters And Ranges	Location	No. Used
Allen Test Products 2101 N. Pitcher Street Kalamazoo, MI 49007	Allen CO/HC Infrared Exhaust Analyzer Model 23-060 Optical bench from Sensors, Inc., electronic integral calibration, external gas calibration	Dual meters, 8-in. scale coupled high and low ranges HC: (HR)*0-2000 ppm; (LR) 0-500 ppm CO: (HR) 0-10%; (LR) 0-2.5%	Ft. Sam Houston, TX SwRI	1 1
Barnes Engineering Co. 30 Commerce Road Stamford, CT 06904	Barnes Model 1836 Infrared Exhaust Performance Analyzer Single analyzer, single-beam chopped radiation, thermistor detector (Barnes), electronic internal calibration, both ranges, modular design	Dual meters, 8-in. scales; independent high and low ranges HC: (HR) 0-2000 ppm; (LR) 0-400 ppm CO: (HR) 0-10%; (LR) 0-2%	Ft. Sam Houston, TX Pine Bluff Arsenal	1 1
Beckman Instruments, Inc. 2500 Harbor Blvd. Fullerton, CA 92634	Beckman Model 590 HC/CO Exhaust Analyzer Dual analyzers, single-beam chopped radiation, focused ceramic-glazed special-alloy source (BII manufacturer), electronic internal calibration, separate span adjust on high and low ranges, modular design	Dual meters, 8-in. scales; independent high and low ranges HC: (HR) 0-2000 ppm; (LR) 0-400 ppm CO: (HR) 0-10%; (LR) 0-2%	Ft. Lewis, WA	2
Sun Electric Corp. 3011 E. Route 176 Crystal Lake, IL 60014	Sun Model EPA 75 Exhaust Performance Analyzer Optical bench and electronics from Infrared Industries, Inc.; push-button operation	Dual meters, 8-in. scale; independent high and low ranges HC: (HR) 0-2000 ppm; (LR) 0-500 ppm CO: (HR) 0-10%; (LR) 0-2.5%	Pine Bluff Arsenal	1

* HR - High Range; LR - Low Range

the maintenance shop where the analyzers were located. The zero adjustment was set for both HC and CO, the probe was then placed in the vehicle exhaust pipe, and the results were recorded. Adjustments of the carburetor fuel metering valves were then made to lean or enrichen the fuel mixture to produce the lowest possible HC/CO level. The adjusted results were then recorded. If adjustments were not possible due to misfiring, etc., maintenance recommendations were given to the maintenance shop superintendent. These recommendations generally could not be acted upon since doing so would have interrupted established maintenance procedures. However, failure to take immediate corrective actions (e.g., ignition wiring and/or plug replacement/repairs) may well have contributed to a lack of significant improvement in fuel economy.

2. Control Vehicles

The control vehicles were also operated to bring the engine to normal operating temperature prior to exhaust sampling. The results of emission levels were recorded; no adjustments were made nor was any maintenance recommended. These vehicles (and the test group) continued to be subject to regular scheduled routine maintenance throughout the program.

A typical data sheet used for recording exhaust emission levels and maintenance data is shown as Figure 1. Figures 2 and 3 show typical commercial and tactical "test" vehicles being adjusted to obtain lowest possible HC/CO level.

Tables 3a through 7b present information on individual vehicles utilized in the program by installation. These tables include the overall averages for fuel economy (mpg), CO (%), and HC (ppm). All maintenance performed on the vehicles is also included in the tables.

D. Test Results

Table 8 presents 12-month averages for test and control fleet fuel economy and carbon monoxide and hydrocarbon emissions. These data are subclassified by vehicle type for each of the three installations. Differences between test and control means are expressed as percent increase or decrease based upon each control fleet average. In addition, overall averages for sedans and nontactical trucks as well as for tactical vehicles have been calculated by combining these vehicle classes from the three installations. It is im-

FIELD EMISSIONS DATA

VEHICLE NO.		TYPE		LOCATION		
CB9195		PU Chev. 1974		Ft. Sam Houston, TX		
DATE	ODOMETER	BEFORE		AFTER		SERVICE-REMARKS
		CO, %	HC, PPM	CO, %	HC, PPM	
8 Mar 78	49605	0.2	5	-	-	Tune-up - 6 Mar 78; did not adjust
29 Mar 78	49953	0.1	20	-	-	OK
26 Apr 78	50547	0.08	15	-	-	
2 Jun 78	51417	0.15	60	0.18	60	Ignition problem
9 Aug 78	52687	0.55	45	-	-	Tune-up, replaced air filter, plugs, points & condenser, 29 Aug 78
13 Sep 78	53355	0.13	100	0.2	200	Unable to adjust
18 Oct 78	54056	7.4	1850	1.9	140	Bad carburetor; replaced carburetor - 18 Oct 78
15 Nov 78	54583	0.25	70	-	-	
6 Dec 78	54940	0.10	650	0.1	50	
10 Jan 79	55519	0.05	35	-	-	

FIGURE 1. TYPICAL FIELD EMISSIONS DATA SHEET

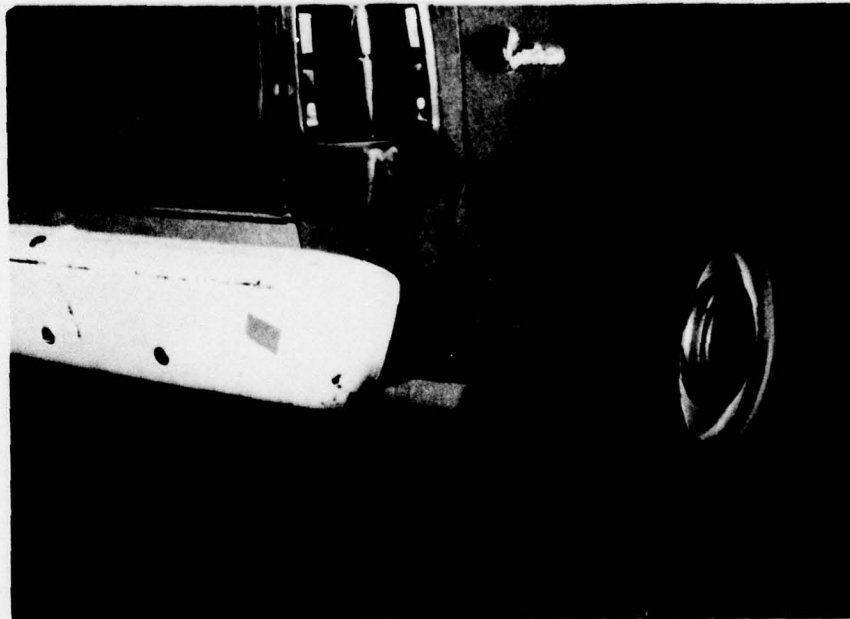


FIGURE 2. TYPICAL ADJUSTMENT AND TAILPIPE PROBE
ON COMMERCIAL PICKUP TRUCK

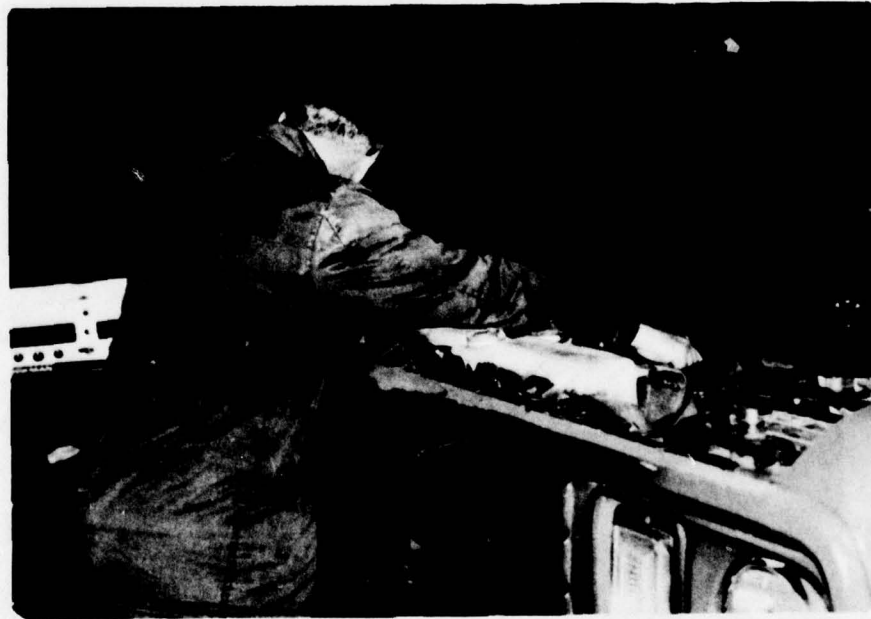


FIGURE 3. TYPICAL ADJUSTMENT OF AN M880 TACTICAL VEHICLE

TABLE 3a. PINE BLUFF ARSENAL CONTROL VEHICLES

Reg. Number	Vehicle	Type	Make	Year	Fuel		CO, %	HC, ppm	Maintenance Performed
					Economy, mpg	HC, ppm			
CA-0303	Auto	Sedan	Ford	1972	10.3	335	4.8	335	Tune-up 6 Feb 78; insp. 12,000 mi. 10 Feb 78; insp. 6,000 mi., replaced element Apr 78; replaced plugs, pts. 15 Jun 78; insp. 12,000 mi., replaced plugs, pts. 23 Jun 78; salvaged 12 Oct 78.
CA-0665	Auto	Sedan	AMC	1972	10.4	771	8.3	771	Insp. semi-annual 3 Feb 78; insp. annual Jul 78; salvaged 12 Oct 78.
CA-1269	Auto	Sedan	Ford	1972	10.4	242	7.9	242	Insp. annual, replaced plugs, pts., rotor 1 May 78; eng. repaired 11 Jul 78; insp. semi-annual 20 Oct 78.
CA-2003	Auto	Sedan	AMC	1972	12.1	1003	4.9	1003	Replaced plugs 31 May 78; insp. 6,000 mi. 15 Jun 78; replaced plugs, pts. 3 Aug 78; replaced dist. cap 5 Aug 78; salvaged 10 Nov 78.
CF-4265	Auto	Sedan	AMC	1977	19.4	154	1.6	154	Insp. annual 18 Jul 78; carb. kit instl'd. 15 Jan 79.
CF-0677	Auto	Station wagon	AMC	1977	13.8	16	0.02	16	Insp. semi-annual, replaced element 3 Mar 78; insp. 12,000 mi. 7 Aug 78.
CF-0776	Auto	Station wagon	AMC	1977	15.7	18	0.02	18	Insp. semi-annual 7 Feb 78; insp. 12,000 mi. 7 Jul 78.
CA-4707	Truck	PU 1/2T	Chev	1972	8.6	487	3.6	487	Insp. annual, replaced plugs, pts., element 7 Apr 78; replaced plugs, air filter 10 May 78; insp. semi-annual, replaced plugs, pts. 14 Nov 78.
CA-4711	Truck	PU 1/2T	Chev	1972	8.5	196	5.6	196	Insp. annual, replaced plugs, pts. 8 Mar 78; salvaged 12 Jul 78.
CA-4720	Truck	PU 1/2T	Chev	1972	9.1	1298	5.9	1298	Replaced plugs, pts., repaired eng. and trans. 9 Feb 78; insp. 12,000 mi., replaced plugs, pts., cond. 7 Apr 78; replaced plugs, pts., fuel pump 1 Jun 78; eng. repaired 31 Jul 78; insp. semi-annual 11 Oct 78.
CA-4727	Truck	PU 1/2T	Chev	1972	10.5	60	2.0	60	Insp. 6,000 mi., replaced plugs, pts., element 19 Mar 78; replaced mod. valve, plugs, pts., 18 May 78; insp. annual 28 Sept 78; repaired carb. 2 Oct 78.
CB-8699	Truck	PU 1/2T	Chev	1974	9.5	55	2.3	55	Insp. annual, replaced plugs, pts., element 3 Apr 78; replaced plugs, pts. 7 Aug 78; insp. semi-annual 27 Sept 78.
CB-8700	Truck	PU 1/2T	Chev	1974	7.6	35	1.5	35	Insp. annual 2 Feb 78; replaced plugs, pts., 1 Jun 78; corrected hard starting eng. 26 Jul 78; insp. semi-annual 14 Aug 78; replaced plugs, pts. 29 Aug 78; replaced plugs, pts. 10 Oct 78.
CB-8701	Truck	PU 1/2T	Chev	1974	11.4	48	0.5	48	Insp. annual, replaced plugs, pts., element 27 Mar 78; replaced trans. 31 Mar 78; insp. semi-annual 8 Sept 78; replaced plugs, pts. 11 Oct 78.
CB-8702	Truck	PU 1/2T	Chev	1974	11.0	66	2.1	66	Insp. semi-annual, replaced element 14 Apr 78; insp. annual, replaced plugs, pts., fuel pump 10 Oct 78.
CB-8703	Truck	PU 1/2T	Chev	1974	7.3	779	1.3	779	Insp. 6,000 mi., tune-up replaced plugs, pts. 8 Feb 78; replaced plugs, pts. 13 Mar 78; insp. 12,000 mi., replaced plugs, pts. and element 31 Mar 78; replaced plugs, pts. 18 Apr 78; replaced camshaft, lifters, gears, chains 14 Nov 78; insp. 12,000 mi. 16 Nov 78.
CB-8704	Truck	PU 1/2T	Chev	1974	8.8	57	2.5	57	Tune-up 14 Feb 78; tune-up 28 Apr 78; insp. semi-annual, replaced plugs, pts., filter 3 May 78; corrected eng. misfiring 8 Jun 78.
CB-8705	Truck	PU 1/2T	Chev	1974	6.4	443	1.8	443	Insp. 12,000 mi. 2 Feb 78; insp. 6,000 mi., replaced oil filter 5 May 78; corrected rough running eng. 29 Aug 78; replaced plugs, pts. 6 Oct 78; replaced plugs, pts. 19 Nov 78; insp. annual, replaced plugs, pts., ign. switch 6 Dec 78.
CB-8706	Truck	PU 1/2T	Chev	1974	7.2	56	1.7	56	Replaced plugs 5 Apr 78; replaced valve lifters 14 Apr 78; repaired carb. 11 Jul 78; insp. semi-annual 11 Aug 78; corrected rough running eng. 2 Oct 78.
CB-8707	Truck	PU 1/2T	Chev	1974	7.7	573	1.8	573	Tune-up 21 Feb 78; replaced plugs, pts. 18 Apr 78; replaced modulator, plugs, pts. 24 Apr 78; tune-ups 11-12 May 78; insp. 12,000 mi., replaced plugs, pts. 19 May 78; tune-up 26 Oct 78; insp. 6,000 mi. 20 Dec 78.
CB-8708	Truck	PU 1/2T	Chev	1974	6.6	83	2.3	83	Major eng. repair 30 Jan 78; insp. 6,000 mi. 14 Feb 78; salvaged 30 Mar 78.
CB-8709	Truck	PU 1/2T	Chev	1974	7.9	69	2.4	69	Insp. 6,000 mi., replaced plugs 31 Jan 78; insp. 12,000 mi., replaced plugs, pts. 27 Apr 78; replaced camshaft, valve lifters 7 Jul 78; insp. 6,000 mi. 4 Aug 78; tune-up 5 Nov 78.
CB-8710	Truck	PU 1/2T	Chev	1974	8.5	72	1.8	72	Replaced dist. cap 16 Mar 78; insp. 6,000 mi., replaced plugs, pts., element 21 Mar 78; tune-ups 5 and 9 May 78; replaced plugs 14 Jun 78; insp. 12,000 mi., replaced plugs 26 Jun 78; replaced fuel pump 14 Jul 78; insp. 6,000 mi., replaced plugs, pts. 2 Nov 78.

TABLE 3a. PINE BLUFF ARSENAL CONTROL VEHICLES (Cont'd)

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
CB-8711	Truck	PU 1/2T	Chev	1974	4.6	1.6	83	Replaced pts. 30 Jan 78; insp. annual, replaced plugs, pts., cond., filter 6 Mar 78; replaced valve lifters 3 Apr 78; replaced dist. cap 25 Apr 78; tune-up 15 May 78; insp. 6,000 mi., replaced plugs, pts., air filter 2 Jun 78.
CB-8712	Truck	PU 1/2T	Chev	1974	5.2	1.5	83	Replaced plugs, pts. 11 Apr 78; insp. 6,000 mi., replaced air filter 5 May 78; replaced camshaft 15 Sept 78; replaced plugs, pts., u-joint 14 Nov 78.
CB-8713	Truck	PU 1/2T	Chev	1974	7.0	4.6	147	Insp. 12,000 mi., replaced plugs, pts. 8 Feb 78; tune-up 14 Feb 78; insp. 6,000 mi., replaced plugs, pts., filter 10 May 78; replaced plugs, pts. 25 May 78; insp. 12,000 mi., replaced plugs, pts. 8 Aug 78; replaced plugs, pts., coil 16 Nov 78.
CB-8714	Truck	PU 1/2T	Chev	1974	6.6	3.0	328	Tune-up 30 Jan 78; tune-up 17 Feb 78; insp. 6,000 mi., plugs, pts., filter 2 Mar 78; tune-up 11 May 78; insp. 12,000 mi., replaced filter 15 Jun 78; tune-up 30 Oct 78; insp. 6,000 mi., replaced plugs, pts., 10 Dec 78; replaced plugs, pts. 15 Jan 79.
CB-8715	Truck	PU 1/2T	Chev	1974	8.3	3.0	88	Insp. annual, plugs, pts., filter 9 Mar 78; insp. semi-annual 5 Sept 78; corrected rough running eng. 5 Nov 78.
CB-8716	Truck	PU 1/2T	Chev	1974	9.0	2.8	166	Replaced fuel pump 6 Feb 78; insp. 6,000 mi. 10 Feb 78; insp. 12,000 mi., replaced plugs, pts., filter, carb. kit 12 May 78; replaced plugs, pts. 12 Sept 78; insp. 6,000 mi. 27 Oct 78; tune-up 7 Nov 78; tune-up 28 Nov 78.
CB-8717	Truck	PU 1/2T	Chev	1974	12.1	0.9	40	Insp. annual, replaced plugs, pts., element 28 Feb 78; replaced plugs, pts. 4 Apr 78; repaired carb. 7 Aug 78; insp. semi-annual, replaced plugs, pts. 5 Sept 78; corrected rough running eng. 14 Sept 78.
CB-8719	Truck	PU 1/2T	Chev	1974	9.2	2.0	60	Insp. annual, replaced plugs, pts., element 20 Mar 78; corrected rough running eng. 15 Jun 78; insp. semi-annual 20 Sept 78; tune-up, replaced plugs, pts. 14 Nov 78.
CB-8720	Truck	PU 1/2T	Chev	1974	12.0	1.4	117	Repaired eng. and trans. 21 Feb 78; insp. 12,000 mi. 6 Jun 78; insp. 6,000 mi. 5 Dec 78.
CB-8721	Truck	PU 1/2T	Chev	1974	10.4	1.3	48	Insp. annual, replaced plugs, pts., element 16 Mar 78; insp. semi-annual 28 Sept 78.
CB-8722	Truck	PU 1/2T	Chev	1974	10.7	1.8	73	Insp. 12,000 mi., replaced plugs, pts. 1 Mar 78; insp. 6,000 mi., replaced air filter 19 Jun 78; insp. annual, replaced plugs, pts. 20 Dec 78.
CB-8723	Truck	PU 1/2T	Chev	1974	9.8	1.4	54	Insp. annual, replaced plugs, pts., filter 10 Feb 78; insp. semi-annual 10 Aug 78; corrected rough running eng. 23 Oct 78.
CB-8724	Truck	PU 1/2T	Chev	1974	9.4	1.0	42	Insp. annual, replaced plugs, pts., element 13 Mar 78; insp. semi-annual 7 Sept 78.
CB-8725	Truck	PU 1/2T	Chev	1974	9.8	2.5	119	Insp. annual, replaced plugs, pts., element 9 Mar 78; carb. rebuilt 31 Mar 78; insp. semi-annual 11 Sept 78; tune-up 7 Nov 78.
CB-8726	Truck	PU 1/2T	Chev	1974	10.5	0.7	75	Tune-up 30 Jan 78; insp. annual, replaced plugs, pts., filter 10 Mar 78; corrected rough running eng. 20 Jun 78; insp. semi-annual 13 Sept 78.
CB-8727	Truck	PU 1/2T	Chev	1974	10.2	0.9	45	Insp. annual, replaced plugs, pts., element 20 Mar 78; insp. semi-annual, replaced plugs, pts. 25 Sept 78.
CB-8728	Truck	PU 1/2T	Chev	1974	11.2	1.5	40	Insp. annual, replaced plugs, pts., element 3 Apr 78; insp. semi-annual 19 Sept 78.
CB-8729	Truck	PU 1/2T	Chev	1974	7.7	1.9	37	Insp. semi-annual, replaced plugs, pts., dist. cap, element 8 Mar 78; replaced starter 4 May 78; corrected hard starting eng. 16 Jun 78; insp. annual, replaced plugs, pts. 2 Oct 78.
CB-8730	Truck	PU 1/2T	Chev	1974	8.2	2.3	80	Replaced pts. 21 Jan 78; replaced plugs, pts. 9 Feb 78; insp. annual, replaced plugs, pts., element 24 Mar 78; replaced plugs 26 Jul 78; insp. semi-annual, replaced plugs, pts. 22 Sept 78; replaced ign. coil 26 Nov 78; replaced plugs 6 Dec 78.
CA-2727	Truck	Van (Amb.)	Dodge	1972	9.9	8.0	264	Repaired hung choke (carb.) 25 Jan 79.
OIA-95972	Truck	4T	IHC	1972	6.3	4.0	269	Insp. annual, replaced plugs, pts., filters 10 May 78; insp. semi-annual 20 Nov 78.
OIN-50070	Truck	Van	Chev	1971	9.5	5.6	449	Replaced plugs, pts., cond. 30 Jan 78; tune-up 31 Jan 78; insp. annual, replaced plugs, pts., starter and elements 22 Jul 78; corrected hard starting 9 Aug 78; corrected hard starting 15 Sept 78; corrected rough running eng. 30 Sept 78.
OIN-58870	Truck	Van	Chev	1971	13.3	6.1	476	Insp. annual, replaced plugs, pts., cap and rotor, air filter 21 Jun 78; corrected rough running eng. 12 Jul 78; corrected rough running eng. 12 Sept 78; corrected rough running eng. 17 Oct 78; insp. 6,000 mi., replaced plugs, pts., cond. 4 Dec 78; replaced fuel pump 17 Jan 79.
OIS-90170	Truck	4T	Dodge	1970	9.3	3.2	109	Insp. semi-annual, replaced plugs, pts. Feb 78; corrected rough running eng. 24 Jul 78; insp. annual, replaced plugs, pts., cond. 21 Aug 78; corrected rough running eng. 24 and 28 Aug 78; corrected hard starting eng. 30 Aug 78.

TABLE 3b. PINE BLUFF ARSENAL TEST VEHICLES

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
CA-0664	Auto	Sedan	AMC	1972	12.0	2.6	792	Replaced plugs, pts. and element 17 Apr 78; replaced plugs, pts. and cond. 26 Jun 78; replaced plugs, pts., insp. 12,000 mi., 9 Aug 78; salvaged 10 Nov 78.
CA-1270	Auto	Sedan	Ford	1972	14.2	3.5	260	Replaced muffler, tail pipe 28 Feb 78; insp. annual 9 Jun 78; replaced pts. 25 Oct 78; replaced pts. 18 Nov 78.
CB-0802	Auto	Sedan	Chev	1973	10.6	0.6	47	Semi-annual insp. 24 Feb 78; insp. annual 21 Aug 78; replaced plugs, pts. 5 Dec 78.
CF-0775	Auto	Sedan	AMC	1977	14.3	0.6	40	Carb. repair 10 Jan 78; insp. 12,000 mi. 6 July 78; insp. semi-annual 26 Jan 79.
CF-4927	Auto	Sedan	AMC	1977	18.1	0.01	15	Insp. semi-annual 27 Feb 78; insp. annual 23 Aug 78.
OIF-75071	Auto	Sedan	Ford	1971	12.7	2.9	168	Replaced radiator 15 Mar 78; insp. annual, replaced plugs, cond. and element 7 Apr 78; salvaged 10 Nov 78.
OIH-83671	Auto	Station Wagon	Ford	1972	7.8	1.7	67	Tune-up 29 Mar 78; replaced water pump 2 May 78; insp. annual, replaced pts. and filter 20 Jun 78.
CA-4708	Truck	PU 1/2T	Chev	1972	8.7	1.5	526	Replaced plugs and leads 21 Feb 78; replaced plugs, pts 10 Apr 78; replaced plugs 19 Apr 78; insp. 6,000 mi., replaced plugs, pts. filter 2 May 78; replaced plugs 16 Jun 78; salvaged 8 Nov 78.
CA-4718	Truck	PU 1/2T	Chev	1972	10.3	1.4	67	Insp. semi-annual, replaced plugs, pts. 24 Feb 78; insp. annual replaced plugs, pts. cond., 25 Aug 78.
CA-4722	Truck	PU 1/2T	Chev	1972	9.5	1.1	39	Insp. semi-annual, replaced plugs, pts., element 14 Apr 78; insp. semi-annual 19 Oct 78.
CA-4730	Truck	PU 1/2T	Chev	1972	9.7	1.5	269	Tune-up 24 Feb 78; replaced plugs, pts., 16 Mar 78; replaced plugs, pts. element insp. annual 20 Apr 78; replaced starter 12 May 78; insp. semi-annual, 26 Oct 78; replaced plugs, pts. 15 Jan 79.
CB-8731	Truck	PU 1/2T	Chev	1974	9.1	0.9	47	Replaced trans. 16 May 78; insp. semi-annual, replaced air filter 6 Jun 78; insp. semi-annual, replaced plugs, pts. and carb. kit 18 Jan 79.
CB-8732	Truck	PU 1/2T	Chev	1974	7.7	0.7	109	Tune-up, replaced plugs 13 Mar 78; insp. 12,000 mi., replaced plugs, pts., cond., rotor, air filter May 78; repaired rough running eng. Jul, Aug, Oct, 78; replaced plugs, pts., 30 Nov 78.
CB-8733	Truck	PU 1/2T	Chev	1974	9.6	0.6	74	Replaced trans. 22 Feb 78; insp. annual, replaced plugs, 28 Jun 78; insp. 6,000 mi. 16 Nov 78.
CB-8734	Truck	PU 1/2T	Chev	1974	8.7	1.0	489	Insp. annual, replaced plugs, pts. 13 Jul 78; rough eng. corrected 12 and 24 Oct 78; replaced plugs, pts. 15 Jan 79; insp. semi-annual 25 Jan 79.
CB-8735	Truck	PU 1/2T	Chev	1974	9.3	1.0	50	Insp. semi-annual 23 Feb 78; replaced plugs, pts. 30 Jan 78; insp. annual, replaced plugs, pts. 31 Aug 78.
CB-8736	Truck	PU 1/2T	Chev	1974	9.6	1.2	203	Tune-up, replaced plug, wire 11 Apr 78; insp. annual, replaced plugs, pts. 14 Jul 78; insp. semi-annual 30 Jan 79.
CB-8737	Truck	PU 1/2T	Chev	1974	10.0	1.1	53	Insp. 6,000 mi. 6 Feb 78; replaced plugs 19 Apr 78; replaced plugs 27 Jun 78; insp. 12,000 mi. 3 Aug 78.
CB-8738	Truck	PU 1/2T	Chev	1974	18.3	1.0	51	Insp. 12,000 mi. 23 Feb 78; tune-up 17 Mar 78; insp. 6,000 mi. May 78; eng. repair 2 Jun 78; insp. 12,000 mi. 21 Aug 78.
CB-8739	Truck	PU 1/2T	Chev	1974	8.7	1.2	93	Tune-up 28 Mar 78; replaced plugs, pts., element 6 Apr 78; tune-up 16 May 78; replaced plugs 15 Jun 78; eng. chng'd. 17 Aug 78; insp. annual, replaced plugs, pts. 27 Sept 78.
CB-8740	Truck	PU 1/2T	Chev	1974	9.6	1.0	34	Insp. annual, replaced plugs, pts., 19 Jul 78; tune-up 29 Sept 78; ins. semi-annual, replaced plugs, pts. 22 Jan. 79.
CB-8741	Truck	PU 1/2T	Chev	1974	9.0	0.9	39	Insp. semi-annual, replaced plugs, pts. 30 Jan 78; replaced plugs 27 Jun 78; insp. annual 26 Jul 78; insp. 6,000 mi., replaced plugs, pts. 28 Nov. 78.
CB-8742	Truck	PU 1/2T	Chev	1974	11.4	0.7	31	Replaced plugs, pts., cond., dwell set Feb 78; insp. annual 10 Mar 78; 12,000 mi. 31 May 78;
CB-8743	Truck	PU 1/2T	Chev	1974	12.8	1.0	556	replaced plugs, pts., 10 Oct 78; insp. 6,000 mi., replaced plugs, pts. 15 Nov 78.

TABLE 3b. PINE BLUFF ARSENAL TEST VEHICLES (Cont'd)

Reg. Number	Vehicle	Type	Make	Year	Fuel		CO, %	HC, ppm	Maintenance Performed
					Economy, mpg	Consumption, mpg			
CA-8744	Truck	PU 1/2T	Chev	1974	10.2	0.6	39	Insp. annual 28 Jul 78; corrected rough running eng. 7 Sept 78.	
CA-8745	Truck	PU 1/2T	Chev	1974	8.6	1.6	36	Tune-up, carb. kit 6 Feb 78; replaced plugs 14 Aug 78; insp. semi-annual, replaced plugs, pis. 15 Sept 78; replaced fuel pump 14 Nov 78; replaced PCV valve, rebuilt carb. 16 Jan 79.	
CA-8746	Truck	PU 1/2T	Chev	1974	7.3	0.8	277	Tune-up 3 Feb 78; insp. annual, replaced plugs, pis. 7 Jul 78; eng. repair 19-23 Oct 78; replaced plugs, pis., rotor, dist. cap 17 Dec 78; insp. semi-annual 4 Jan 79.	
CA-8747	Truck	PU 1/2T	Chev	1974	10.6	0.9	33	Insp. 12,000 mi., replaced plugs 12 May 78; eng. repair 19 Sept 78; insp. semi-annual 8 Nov 78.	
CA-8748	Truck	PU 1/2T	Chev	1974	8.7	0.4	34	Insp. semi-annual 5 Sept 78; replaced plugs, 12 Sept 78.	
CA-8749	Truck	PU 1/2T	Chev	1974	8.2	1.3	235	Tune-up, replaced plugs 11 Apr 78; insp. annual, replaced plugs, pis. 27 Jun 78; tune-up 29 Nov 78; insp. semi-annual 21 Dec 78; replaced plugs, pis. 5 Jan 79.	
CA-8750	Truck	PU 1/2T	Chev	1974	10.4	1.0	42	Insp. semi-annual, replaced plugs, pis. 31 Jan 78; insp. annual, replaced plugs, pis. and element 29 Mar 78; insp. semi-annual 27 Sept 78.	
CA-8751	Truck	PU 1/2T	Chev	1974	9.2	0.3	44	Insp. annual, replaced plugs, pis., element 24 Mar 78; eng. repaired 30 Aug 78; insp. semi-annual, replaced plugs and pis. 29 Sept 78.	
CA-8752	Truck	PU 1/2T	Chev	1974	9.7	1.8	49	Insp. annual, replaced plugs, pis., filter, carb. kit 28 Apr 78; replaced plugs, pis. 23 Jun 78; replaced plugs, pis. 25 Jul 78; eng. repaired 20 Sept 78.	
CA-8753	Truck	PU 1/2T	Chev	1974	16.8	1.0	69	Insp. 6,000 mi. 5 Apr 78; insp. 12,000 mi., replaced plugs, pis. 4 Aug 78.	
CC-3847	Truck	PU 1/2T	Chev	1974	10.6	0.5	48	Insp. annual, replaced plugs, pis., element 17 Apr 78; insp. semi-annual 23 Oct 78.	
CC-3848	Truck	PU 1/2T	Chev	1974	9.7	0.7	45	Insp. annual, replaced plugs, pis. 19 Jul 78; replaced plugs, pis., oil filter 24 Jul 78.	
CC-3849	Truck	PU 1/2T	Chev	1974	8.3	0.7	61	Adj. carb 29 Sept 78; eng. repair 13 Oct 78; tune-up, replaced fuel pump 18 Oct 78.	
CC-3850	Truck	PU 1/2T	Chev	1974	10.5	1.0	30	Insp. annual, replaced plugs, pis., carb kit 9 Aug 78.	
CC-3851	Truck	PU 1/2T	Chev	1974	9.3	0.7	234	Replaced fuel pump 18 Jul 78; replaced plugs, pis. 4 Dec 78.	
CC-4155	Truck	PU 1/2T	Chev	1974	9.4	0.9	44	Insp. semi-annual, replaced plugs, pis., element 10 Apr 78; insp. annual, replaced plugs, pis. 10 Oct 78.	
CC-4156	Truck	PU 1/2T	Chev	1974	8.8	1.0	37	Tune-up 2 Feb 78; replaced plugs 6 Mar 78; insp. semi-annual, replaced element 4 Apr 78; replaced plugs, pis. 7 Apr 78; replaced trans. 20 Apr 78; repaired trans. 6 May 78; insp. annual, replaced plugs, pis. 27 Sept 78.	
CD-5960	Truck	PU 1/2T	Dodge	1976	11.5	1.2	84	Insp. semi-annual, replaced plugs, pis. 16 Feb 78; tune-up 9 Mar 78; insp. annual 8 Aug 78.	
CC-8940	Truck	4T	IHC	1975	7.7	1.4	138	Insp. semi-annual, replaced plugs, pis., cond. 30 Jan 78; insp. annual 19 Jul 78; insp. semi-annual, replaced plugs, pis., cond. 23 Jan 79.	
CE-9005	Truck	Van (Amb.)	Chev	1977	8.1	1.6	184	Insp. annual 20 Jul 78.	
OIA-98772	Truck	4T	IHC	1972	0	1.1	120	Replaced several plugs 15 May 78; insp. semi-annual 13 Jul 78; insp. annual, replaced plugs, pis., cond. 5 Jan 79.	
OIN-50170	Truck	Van	Chev	1971	11.9	0.3	205	Replaced vac. line, carb. to trans. Feb 78; insp. semi-annual, replaced air filter, plugs, pis. 6 Jun 78; replaced ign. coil 14 Nov 78; insp. annual, replaced plugs, pis. 7 Dec 78.	
OIN-62470	Truck	Van	Chev	1971	9.6	0.6	63	Replaced plugs, pis., element 28 Mar 78; insp. semi-annual, replaced plugs, pis., cond. 12 Oct 78.	

TABLE 4a. FT. SAM HOUSTON CONTROL VEHICLES

Reg. Number	Vehicle	Type	Make	Year	Fuel		CO, %	HC, ppm	Maintenance Performed
					Economy, mpg	HC, ppm			
CB-2504	Auto	Sedan	Chev	1973	10.9	1.15	44	Salvaged 29 Aug 78.	
CB-2506	Auto	Sedan	Chev	1973	13.7	2.1	26	Tune-up, replaced air, oil filters 22 Jun 78.	
CA-2090	Auto	Sedan	AMC	1972	13.5	3.8	359	Replaced pis., rotor, cond. 3 Jan 78; replaced plugs, pis., cond. 10 Jul 78; salvaged 3 Nov 78.	
CA-1424	Auto	Sedan	Ford	1972	8.6	3.5	108	Replaced plugs, pis., cond. 1 Mar 78; replaced plugs, pis., cond. 23 Aug 78; repaired carb. 14 Sept 78.	
CA-2493	Auto	Sedan	AMC	1972	8.8	5.4	625	Replaced plugs, pis., cond., wires 19 Jan 78; tune-up 7 Jun 78; tune-up 26 July 78; tune-up 6 Sept 78; replaced plugs 22 Dec 78.	
CA-2088	Auto	Sedan	AMC	1972	10.6	7.1	754	Replaced plugs, pis., cond., carb. 13 Jan 78.	
CA-0305	Auto	Sedan	Ford	1972	10.9	2.3	101	Adjusted carb. 5 Jul 78; salvaged 5 Dec 78.	
CB-2518	Auto	Sedan	Chev	1973	9.4	3.0	229	Tune-up 30 Mar 78; replaced plugs, oil filter, choke cleaned 15 Jun 78; replaced ign. wires, dist. cap 14 Nov 78.	
CA-0828	Auto	Sedan	AMC	1972	13.4	2.3	587	Replaced plugs, pis., cond. 3 Jan 78; replaced ign. coil, cond. 12 Jun 78.	
CB-0438	Auto	Sedan	Chev	1973	9.6	0.9	36	Replaced pis., cond., rotor and carb. 16 Mar 78; replaced dist. cap 4 Apr 78.	
CB-0459	Auto	Sedan	Chev	1973	9.3	1.4	34	Replaced plugs, pis., cond., PCV valve 2 Aug 78.	
CB-0463	Auto	Sedan	Chev	1973	9.4	1.8	25	Tune-up 7 Mar 78; replaced plugs, pis., cond. 8 Sept 78.	
CB-0464	Auto	Sedan	Chev	1973	10.6	1.3	43		
CF-4160	Auto	Sedan	Ford	1977	15.3	1.0	130	Tune-up 29 Jun 78.	
CF-4162	Auto	Sedan	Ford	1977	13.6	0.4	101	Tune-up 15 Feb 78; replaced plugs 6 Jun 78; replaced plugs 9 Nov 78.	
CF-4166	Auto	Sedan	Ford	1977	12.5	1.1	255	Tune-up 12 Jan 78; tune-up 17 Jul 78; replaced plugs, rotor 11 Dec 78.	
CF-4167	Auto	Sedan	Ford	1977	16.7	0.4	105	Tune-up 18 May 78; replaced plugs, air filter 21 Nov 78.	
CF-4171	Auto	Sedan	Ford	1977	16.2	0.6	130		
CF-4813	Auto	Sedan	AMC	1977	31.1	3.1	108		
CF-4814	Auto	Sedan	AMC	1977	23.6	0.4	45	Replaced plugs, rotor, dist. cap 11 May 78; tune-up, cleaned/adj. plugs 28 Aug 78.	
CF-4818	Auto	Sedan	AMC	1977	17.9	0.04	32	Replaced plugs 30 Aug 78.	
CF-4821	Auto	Sedan	AMC	1977	17.2	0	11	Tune-up 10 Mar 78; replaced plugs 12 May 78; tune-up 2 Jun 78; replaced air filter 27 Nov 78.	
CD-6933	Auto	Station Wagon	Ford	1975	8.3	0.78	71	Tune-up, replaced rotor 22 Sept 78.	
CD-6935	Auto	Station Wagon	Ford	1975	13.4	4.2	162	Replaced plugs PCV valve 27 Feb 78.	
CCE-2071	Auto	Station Wagon	AMC	1976	11.5	3.8	359	Cleaned/gapped plugs 1 Jun 78; tune-up 2 Jun 78; replaced plugs, PCV valve, air filter 7 Nov 78; replaced dist. cap, rotor 21 Nov 78.	
CF-0767	Auto	Station Wagon	AMC	1977	23.6	0.2	50		

TABLE 4a. FT. SAM HOUSTON CONTROL VEHICLES (Cont'd)

Reg. Number	Vehicle	Type	Make	Year	Fuel		CO, %	HC, ppm	Maintenance Performed
					Economy, mpg	HC, ppm			
CA-4824	Truck	PU 1/2T	Chev	1972	8.4	38	1.7		Replaced pts., cond., rotor, dist. cap 7 Mar 78.
CA-4825	Truck	PU 1/2T	Chev	1972	9.8	40	2.1		Replaced pts., cond., rotor, dist. cap 4 Aug 78; salvaged 7 Dec 78.
OID-82672	Truck	PU 1/2T	Chev	1972	9.9	48	1.8		Replaced pts., cond., plugs, wires 22 Mar 78; replaced plugs 12 May 78; replaced plugs, pts., cond., wiring 3 Aug 78.
OIC-13971	Truck	PU 1/2T	Dodge	1971	8.3	186	4.9		Replaced plugs, pts. 28 Mar 78; tune-up 31 Aug 78; salvaged 14 Nov 78.
OIC-14071	Truck	PU 1/2T	Dodge	1971	10.0	561	4.0		Replaced pts., cond. 24 Feb 78; replaced all valve lifters 13 Apr 78; carb. adj. 31 May 78; replaced plugs, pts., cond. 18 Aug 78; salvaged 4 Jan 79.
CA-4833	Truck	PU 1/2T	Chev	1972	8.7	35	1.4		Replaced plugs, wires 14 Feb 78; tune-up 25 Apr 78; replaced plugs 30 Nov 78; replaced pts., cond., adj. choke 6 Dec 78.
CA-4835	Truck	PU 1/2T	Chev	1972	12.0	140	2.0		Tune-up 21 Feb 78; replaced pts., cond. 27 Apr 78.
OID-82872	Truck	PU 1/2T	Chev	1972	7.4	63	2.5		Tune-up 3 Mar 78; tune-up 24 May 78.
OIC-14271	Truck	PU 1/2T	Dodge	1971	10.4	200	4.3		Replaced plugs, pts., cond., dist. cap, air filter 22 Jun 78; salvaged 4 Jan 79.
CA-4838	Truck	PU 1/2T	Chev	1972	8.0	93	2.4		Replaced plugs 7 Jan 78; tune-up 20 Mar 78; tune-up 3 Jul 78.
CA-4842	Truck	PU 1/2T	Chev	1972	7.8	52	2.0		Tune-up 24 May 78; replaced plugs, pts., cond., air filter 24 Nov 78.
OID-83172	Truck	PU 1/2T	Chev	1972	4.5	44	1.8		Replaced plugs, pts., rotor wires 13 Feb 78.
CA-4848	Truck	PU 1/2T	Chev	1972	7.4	38	1.4		Replaced carb., pts., rotor 11 Mar 78; tune-up 12 Jul 78.
CA-4850	Truck	PU 1/2T	Chev	1972	8.0	303	2.4		Replaced plugs, pts., cond. 31 Jul 78; tune-up 28 Aug 78.
CB-9189	Truck	PU 1/2T	Chev	1974	8.1	22	0.5		Tune-up 31 Mar 78; replaced plugs, pts., cond., rotor, air filter 2 Oct 78.
CB-9191	Truck	PU 1/2T	Chev	1974	9.7	29	1.2		Tune-up 23 Mar 78; replaced plugs, pts., cond., air filter 14 Sept 78.
CB-9192	Truck	PU 1/2T	Chev	1974	8.3	44	0.8		Tune-up 3 Mar 78.
CB-9203	Truck	PU 1/2T	Chev	1974	7.0	28	1.3		Tune-up 22 Mar 78.
CB-9206	Truck	PU 1/2T	Chev	1974	9.6	54	2.1		Replaced plugs, pts., cond., rotor 10 Mar 78; replaced dist. cap wires, tune-up 11 Mar 78.
CB-9208	Truck	PU 1/2T	Chev	1974	14.2	50	1.3		Replaced plugs, pts., cond., choke cleaned 23 Jun 78; tune-up, replaced ign. wires 18 Sept 78.
CB-9213	Truck	PU 1/2T	Chev	1974	17.3	38	1.2		Tune-up, replaced air filter 6 Feb 78; replaced pts., cond. 1 Aug 78; replaced plugs, wiring, air filter 27 Sept 78.
CB-9215	Truck	PU 1/2T	Chev	1974	7.6	37	1.2		Tune-up 17 Apr 78.
CB-9216	Truck	PU 1/2T	Chev	1974	7.9	78	1.1		Tune-up 9 Mar 78; tune-up 1 Dec 78.
CB-9224	Truck	PU 1/2T	Chev	1974	9.8	540	0.1		Replaced plugs, carb. 19 Jul 78; replaced plugs 3 Nov 78.
CB-9228	Truck	PU 1/2T	Chev	1974	8.4	51	1.6		Tune-up 12 Jan 78.
CB-9231	Truck	PU 1/2T	Chev	1974	7.8	22	2.0		Tune-up 21 Mar 78.
CB-9235	Truck	PU 1/2T	Chev	1974	7.5	321	1.3		Tune-up 23 Feb 78.
CE-0950	Truck	PU 1/2T	Dodge	1976	11.4	104	2.6		Tune-up 17 May 78.
CE-0973	Truck	PU 1/2T	Dodge	1976	12.4	179	6.3		Tune-up 31 Mar 78; tune-up 15 Sept 78.
CF-1455	Truck	PU 1/2T	Dodge	1977	14.8	176	6.0		Replaced plugs 2 Apr 78; replaced plugs, PCV valve, air filter 2 Nov 78.
CF-1456	Truck	PU 1/2T	Dodge	1977	18.9	204	5.1		Tune-up 31 May 78; replaced plugs, PCV valve 5 Dec 78.
CF-1460	Truck	PU 1/2T	Dodge	1977	13.4	151	0.6		Tune-up 7 Jun 78; replaced air filter 11 Dec 78.
CF-1461	Truck	PU 1/2T	Dodge	1977	11.9	4.4	209		Tune-up 2 Jun 78; replaced plugs 1 Dec 78.
CF-1464	Truck	PU 1/2T	Dodge	1977	11.2	86	1.7		Tune-up, replaced oil filter 16 Jun 78; replaced ign. resistor 27 Nov 78.
CF-1451	Truck	PU 1/2T	Dodge	1977	13.9	147	4.6		Adj. automatic choke 1 Nov 78.
CF-1459	Truck	PU 1/2T	Dodge	1977	11.8	104	1.7		Replaced plugs, air filter 7 Aug 78.
					14.3	128	4.7		

TABLE 4b. FT. SAM HOUSTON TEST VEHICLES

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
CB-2498	Auto	Sedan	Chev	1973	7.6	1.7	264	Replaced carb. Feb 78; replaced plugs, pts., dist. cap, cond. 12 Apr 78; tune-up 31 Jul 78; replaced air filter, plugs 20 Oct 78; salvaged 4 Jan 79.
CB-2489	Auto	Sedan	AMC	1973	12.5	1.5	384	Tune-up Jan 78; tune-up 24 Jul 78.
CB-2501	Auto	Sedan	Chev	1973	10.6	0.6	27	Tune-up 21 Mar 78; replaced plugs, pts., cond., dist. cap and rotor, PCV valve 7 Sept 78.
CB-2502	Auto	Sedan	Chev	1973	7.6	0.7	35	Tune-up 21 Mar 78; replaced pts., cond. 7 Aug 78.
CA-1422	Auto	Sedan	Ford	1972	9.9	1.0	43	Replaced plugs, pts., cond. and rotor 4 May 78; adj. carb. 3 Aug 78; replaced plugs, pts., PCV valve 6 Nov 78; tune-up, replaced dist. cap and wiring 14 Dec 78.
CA-0825	Auto	Sedan	AMC	1972	13.2	1.7	266	Tune-up 3 Mar 78; tune-up, replaced air filter 23 Mar 78.
CA-0826	Auto	Sedan	AMC	1972	12.4	1.3	332	Replaced plugs, pts., cond., air filter 31 Oct 78.
CB-2515	Auto	Sedan	Chev	1973	8.9	1.5	38	Replaced plugs, pts., wiring 13 Apr 78; tune-up 5 May 78; checked carb. 25 May 78; replaced plugs, pts., cond., air filter, PCV valve 31 Oct 78; tune-up 6 Dec 78.
CB-2513	Auto	Sedan	Chev	1973	12.2	1.0	39	Replaced plugs, cond. 23 Jan 78; replaced plugs, pts., cond. 30 Jun 78; replaced plugs and air filter 27 Oct 78; salvaged 15 Nov 78.
CB-2514	Auto	Sedan	Chev	1973	7.9	0.8	44	Tune-up 6 Mar 78; replaced plugs, pts., cond. 30 Jun 78; replaced plugs and air filter 27 Oct 78; salvaged 15 Nov 78.
CD-3781	Auto	Sedan	Ply	1975	14.9	0.7	55	Replaced plugs 17 May 78; tune-up, replaced air filter 16 Oct 78.
CF-4157	Auto	Sedan	Ford	1977	12.5	0.3	87	Carb. checked 18 Apr 78; tune-up 18 May 78; replaced plugs, rotor 28 Aug 78.
CF-4158	Auto	Sedan	Ford	1977	17.8	0.05	46	Tune-up 3 Mar 78; replaced plugs, rotor, cap 23 Aug 78.
CF-4164	Auto	Sedan	Ford	1977	17.9	1.0	191	Tune-up 12 May 78.
CF-4168	Auto	Sedan	Ford	1977	13.0	0.02	28	
CF-4169	Auto	Sedan	Ford	1977	17.2	0.03	31	Tune-up 1 Mar 78.
CF-4812	Auto	Sedan	AMC	1977	16.0	0.01	31	Replaced plugs 18 Sept 78.
CF-4815	Auto	Sedan	AMC	1977	21.0	0.02	12	Repaired carb. 15 Sept 78.
CF-4816	Auto	Sedan	AMC	1977	19.7	0.01	14	Tune-up 21 Feb 78; tune-up 19 Jun 78; replaced plugs, air filter 28 Aug 78.
CF-4822	Auto	Sedan	AMC	1977	18.2	0.02	23	Tune-up, replaced PCV valve, air and oil filter 29 Jun 78.
CF-4823	Auto	Sedan	AMC	1977	14.9	0.02	16	Replaced air filter 21 Sept 78.
CF-4825	Auto	Sedan	AMC	1977	19.1	0.03	19	Tune-up 8 Mar 78.
CD-6934	Auto	Station Wagon	Ford	1975	7.7	0.7	133	Tune-up 21 Mar 78; replaced wiring, rotor, dist. cap 4 Apr 78.
CD-6936	Auto	Station Wagon	Ford	1975	13.4	0.3	32	Tune-up 19 Apr 78; adj. carb. 19 Sept 78; replaced carb., sensor tube 21 Nov 78.
CF-0667	Auto	Station Wagon	AMC	1977	13.8	0.2	23	Tune-up 3 Apr 78.
CF-0668	Auto	Station Wagon	AMC	1977	14.5	0.02	16	Tune-up 7 Feb 78; replaced plugs 6 Sept 78.

TABLE 4b. FT. SAM HOUSTON TEST VEHICLES (Cont'd)

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
CA-4823	Truck	PU 1/2T	Chev	1972	13.9	1.4	391	Tune-up 4 Apr 78.
OID-81672	Truck	PU 1/2T	Chev	1972	8.3	0.87	128	Tune-up, replaced plugs, pts., cond., rotor, oil filter, PCV valve 28 Jun 78; replaced plugs, wires 21 Aug 78.
OIC-13671	Truck	PU 1/2T	Chev	1972	7.9	0.87	119	Replaced plugs, pts., cond. and carb. 18 Apr 78; replaced PCV valve 24 May 78; salvaged 3 Jan 79.
CA-4830	Truck	PU 1/2T	Chev	1972	10.9	1.5	49	Tune-up 13 Jan 78; replaced plugs, pts., cond. 18 Oct 78.
OID-82172	Truck	PU 1/2T	Chev	1972	9.5	0.98	54	Replaced plugs, pts. 27 Feb 78; replaced carb. 1 Jun 78; tune-up 20 Jun 78.
OID-82272	Truck	PU 1/2T	Chev	1972	7.7	2.0	250	Replaced plugs, pts., cond., rotor and dist. cap 3 Apr 78; tune-up 21 Sept 78.
OIC-14371	Truck	PU 1/2T	Dodge	1971	9.2	0.70	63	Replaced dist., rotor 17 Feb 78; replaced plugs, pts., cond. 9 Aug 78; tune-up 7 Sept 78; salvaged 9 Nov 78.
CA-4840	Truck	PU 1/2T	Chev	1972	11.1	1.67	154	Replaced plugs, pts., cond., rotor 3 Apr 78; replaced air filter 14 Sept 78.
CA-4841	Truck	PU 1/2T	Chev	1972	7.7	1.55	112	Replaced plugs 27 Apr 78; salvaged 4 Jan 79.
OIC-14671	Truck	PU 1/2T	Dodge	1971	12.0	1.49	342	Tune-up, replaced oil filter 9 Jun 78; salvaged 4 Jan 79.
CA-4846	Truck	PU 1/2T	Chev	1972	7.3	1.94	69	Tune-up 17 May 78; replaced plugs, pts., cond., air filter 21 Nov 78.
OIC-14771	Truck	PU 1/2T	Dodge	1971	12.9	0.6	303	Replaced plugs, pts., cond., air filter 12 Jan 78; replaced plugs, pts., cond. 4 Dec 78; salvaged 8 Jan 79.
OID-81572	Truck	PU 1/2T	Chev	1972	8.6	1.49	84	Replaced pts., cond., rotor, dist. cap and carb. 22 Feb 78; tune-up 25 May 78; tune-up 11 Aug 78.
OID-82972	Truck	PU 1/2T	Chev	1972	10.3	1.58	136	Tune-up 22 Jan 78; tune-up 6 Sept 78; tune-up 15 Sept 78.
CA-4849	Truck	PU 1/2T	Chev	1972	8.7	1.74	45	Replaced plugs, wires 9 Mar 78; replaced pts., cond. 12 Apr 78; tune-up 23 Jun 78; tune-up 5 Jul 78.
CB-9193	Truck	PU 1/2T	Chev	1974	8.6	0.93	62	Tune-up 30 Mar 78; replaced dist. 27 Apr 78.
CB-9195	Truck	PU 1/2T	Chev	1974	9.2	0.34	63	Tune-up 6 Mar 78; tune-up, replaced plugs, pts., cond., air filter 29 Aug 78; replaced carb. 18 Oct 78.
CB-9201	Truck	PU 1/2T	Chev	1974	10.3	0.92	20	Replaced plugs 13 Feb 78.
CB-9202	Truck	PU 1/2T	Chev	1974	8.7	0.99	54	Tune-up 30 Jun 78.
CB-9210	Truck	PU 1/2T	Chev	1974	9.4	0.23	16	Replaced pts. and cond. 3 May 78.
CB-9214	Truck	PU 1/2T	Chev	1974	10.1	0.8	113	Tune-up 9 Jun 78; replaced plugs, pts., cond., air filter 7 Dec 78.
CB-9218	Truck	PU 1/2T	Chev	1974	7.1	0.3	59	Replaced plugs, cond., rotor, dist. cap, EGR valves 27 Feb 78; replaced plugs, pts., cond. 21 Aug 78.
CB-9222	Truck	PU 1/2T	Chev	1974	8.0	0.15	449	Replaced plugs, cond., rotor, dist. cap, rotor, ign. wires and air filter 18 Oct 78.
CB-9223	Truck	PU 1/2T	Chev	1974	9.3	0.68	48	Tune-up 18 May 78; replaced dist. cap, rotor, ign. wires and air filter 18 Oct 78.
CB-9226	Truck	PU 1/2T	Chev	1974	9.9	0.65	35	Tune-up 19 Apr 78; tune-up 2 Jun 78.
CB-9232	Truck	PU 1/2T	Chev	1974	10.6	0.36	36	Replaced pts., cond., rotor 7 Feb 78; tune-up 12 Apr 78.
CB-9233	Truck	PU 1/2T	Chev	1974	12.0	0.56	249	Tune-up, replaced plugs 6 Mar 78; replaced air filter 2 Oct 78.
CE-0952	Truck	PU 1/2T	Dodge	1976	12.6	0.71	104	Replaced plugs 21 Feb 78; replaced plugs 12 Jun 78; replaced plugs 14 Aug 78.
CE-0959	Truck	PU 1/2T	Dodge	1976	11.1	1.3	241	Tune-up 13 Apr 78; replaced plugs 20 Oct 78.
CE-0964	Truck	PU 1/2T	Dodge	1976	13.0	0.36	42	Tune-up 7 Mar 78; replaced plugs, PCV valve, carb. 5 Sept 78.
CE-0965	Truck	PU 1/2T	Dodge	1976	12.4	0.15	41	Tune-up 12 Jun 78; replaced carb. 10 Jul 78.
CF-1447	Truck	PU 1/2T	Dodge	1977	13.8	1.15	160	Tune-up 9 Jun 78; tune-up 7 Jul 78.
CF-1448	Truck	PU 1/2T	Dodge	1977	12.1	0.95	90	Tune-up 9 Jun 78; tune-up, replaced ign. resistor 9 Nov 78; replaced plugs 14 Dec 78.
CF-1452	Truck	PU 1/2T	Dodge	1977	13.7	1.4	142	Tune-up 9 Jun 78; tune-up, replaced ign. resistor 9 Nov 78; replaced plugs 14 Dec 78.
CF-1462	Truck	PU 1/2T	Dodge	1977	12.3	0.71	110	Tune-up Feb 78; tune-up 7 Jul 78.
CF-1463	Truck	PU 1/2T	Dodge	1977	12.0	1.3	116	Tune-up 16 Jun 78; replaced plugs 13 Dec 78.
CF-1449	Truck	PU 1/2T	Dodge	1977	9.8	1.2	102	Replaced plugs, PCV valve, air filter, carb. 8 Nov 78.
CF-1458	Truck	PU 1/2T	Dodge	1977	11.8	0.88	95	Adj. carb. 4 Sept 78.
CF-1979	Truck	PU 1/2T	Dodge	1977	10.2	1.2	137	

TABLE 5a. FT. LEWIS CONTROL VEHICLES

Reg. Number	Vehicle	Type	Make	Year	Fuel			Maintenance Performed
					Economy, mpg	CO, %	HC, ppm	
CA-1009	Auto	Sedan	Ford	1972	12.3	0.5	65	Tune-up, replaced plugs and pts. 23 Jun 78; salvaged 7 Dec 78.
CA-1012	Auto	Sedan	Ford	1972	12.2	4.2	166	
CB-2223	Auto	Sedan	Chev	1973	9.4	0.1	18	Tune-up 5 May 78.
CB-2235	Auto	Sedan	Chev	1973	12.3	0.1	77	
CE-2398	Auto	Sedan	Ford	1976	12.9	1.8	190	Salvaged Jun 78.
CE-2403	Auto	Sedan	Ford	1976	14.0	0.4	189	
CE-2404	Auto	Sedan	AMC	1976	12.2	2.0	244	Tune-up replaced plugs 2 Jan 79.
CF-4644	Auto	Sedan	AMC	1977	15.6	0.2	13	
CF-4651	Auto	Sedan	AMC	1977	20.0	0	20	Replaced plugs, pts., cond., dist. cap, rotor and coil 5 Dec 78.
OJD-66971	Auto	Sedan	Ford	1971	10.6	2.3	648	
CA-4499	Truck	PU 1/2T	Chev	1972	9.5	2.6	42	Tune-up replaced air filter, plugs, pts., and fuel filter 25 Apr 78; tune-up 30 Jun 78; tune-up replaced (3) plugs 24 Jan 79.
CA-4524	Truck	PU 1/2T	Chev	1972	14.6	3.6	184	
CB-9746	Truck	PU 1/2T	Chev	1974	12.5	0.2	44	Replaced plugs, pts., and carb., cleaned air filter 31 Aug 78; tune-up replaced dist. cap and rotor 25 Sept 78; salvaged 7 Dec 78.
CB-9749	Truck	PU 1/2T	Chev	1974	9.0	0.4	187	
CB-9754	Truck	PU 1/2T	Chev	1974	11.3	0.1	116	Salvaged Dec 78.
CB-9757	Truck	PU 1/2T	Chev	1974	10.4	0.4	303	
CB-9762	Truck	PU 1/2T	Chev	1974	12.1	0.1	36	Tune-up replaced air filter, plugs, pts., and fuel filter 25 Apr 78; tune-up 30 Jun 78; tune-up replaced (3) plugs 24 Jan 79.
CB-9765	Truck	PU 1/2T	Chev	1974	11.2	0.2	113	
CB-9776	Truck	PU 1/2T	Chev	1974	8.7	1.2	98	Replaced plugs, pts., and carb., cleaned air filter 31 Aug 78; tune-up replaced dist. cap and rotor 25 Sept 78; salvaged 7 Dec 78.
CB-9781	Truck	PU 1/2T	Chev	1974	16.1	1.0	366	
CE-0742	Truck	PU 1/2T	Dodge	1976	15.2	5.6	183	Salvaged Jan 79.
CE-0812	Truck	PU 1/2T	Dodge	1976	9.9	4.5	113	
CE-0813	Truck	PU 1/2T	Dodge	1976	14.8	5.2	162	Salvaged Dec 78.
CF-1373	Truck	PU 1/2T	Dodge	1977	11.7	7.0	230	
OIK-11470	Truck	PU 1/2T	Ford	1970	15.4	2.8	348	Salvaged 16 Nov 78.
OIK-12570	Truck	PU 1/2T	Ford	1970	11.9	4.2	68	
OIK-13270	Truck	PU 1/2T	Ford	1970	18.6	5.9	1157	Salvaged Dec 78.
CB-6929	Truck	Van	Dodge	1974	10.2	1.8	83	
CC-5592	Truck	Van	Ford	1974	11.0	1.5	91	Salvaged Dec 78.
CE-9505	Truck	Van	Dodge	1977	14.7	0.9	70	
OIB-09172	Truck	Van	Dodge	1972	17.3	2.9	359	Salvaged 16 Nov 78.
OIC-08072	Truck	Van	Dodge	1971	13.8	4.6	416	

TABLE 5b. FT. LEWIS TEST VEHICLES

Administrative

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
CA-1004	Auto	Sedan	Ford	1972	10.6	0.8	157	Tune-up 17 Apr 78; salvaged 11 Dec 78.
CA-1007	Auto	Sedan	Ford	1972	14.3	0.3	19	Salvaged 7 Dec 78.
CA-1013	Auto	Sedan	Ford	1972	8.3	0.3	150	Replaced plugs, pis., air cleaner 18 Apr 78; salvaged 15 May 78.
CB-0412	Auto	Sedan	Chev	1973	17.7	0.8	43	
CB-2221	Auto	Sedan	Chev	1973	11.4	0.3	15	Tune-up 14 Jul 78.
CB-2236	Auto	Sedan	Chev	1973	9.8	0.4	17	Replaced plugs 7 Jul 78.
CE-2399	Auto	Sedan	Ford	1976	16.6	1.2	246	
CE-2400	Auto	Sedan	Ford	1976	14.5	0.4	155	
CE-2407	Auto	Sedan	Ford	1976	16.4	1.0	190	Replaced plugs 26 Jun 78; Tune-up, replaced plugs 6 Jul 78.
CF-4652	Auto	Sedan	AMC	1977	18.1	0	6	
CA-4509	Truck	PU 1/2T	Chev	1972	10.9	1.5	77	Replaced plugs and pis. 29 Oct 78.
CA-4519	Truck	PU 1/2T	Chev	1972	11.5	0.9	93	Tune-up, replaced plugs, pis., cond. 11 Oct 78.
CA-9752	Truck	PU 1/2T	Chev	1974	10.5	0.3	29	Replaced air filter 21 Jul 78; replaced plugs, pis., cond., air cleaner 10 Jan 79.
CA-9763	Truck	PU 1/2T	Chev	1974	9.6	0.4	25	
CA-9779	Truck	PU 1/2T	Chev	1974	10.5	1.3	30	
CA-9782	Truck	PU 1/2T	Chev	1974	9.5	1.0	21	
CA-9901	Truck	PU 1/2T	Chev	1974	9.3	0.5	651	Replaced plugs 19 July 78.
CC-4281	Truck	PU 1/2T	Chev	1974	9.7	0.6	163	Replaced air filter 28 Jun 78.
CC-4286	Truck	PU 1/2T	Chev	1974	13.7	1.6	39	
CC-4287	Truck	PU 1/2T	Chev	1974	11.8	0.2	39	
CC-4294	Truck	PU 1/2T	Chev	1974	10.2	0.2	26	
CE-0818	Truck	PU 1/2T	Dodge	1976	16.3	0.7	52	
CE-0821	Truck	PU 1/2T	Dodge	1976	17.5	0.3	32	
CF-1379	Truck	PU 1/2T	Dodge	1977	16.1	1.0	72	
CF-1380	Truck	PU 1/2T	Dodge	1977	16.0	0.4	58	
OIB-94271	Truck	PU 1/2T	Dodge	1971	11.9	0.9	307	Tune-up, replaced plugs, pis. air and oil filters 14 Jun 78.
OIK-12870	Truck	PU 1/2T	Ford	1970	12.1	1.5	443	Salvaged June 78.
OIK-13870	Truck	PU 1/2T	Ford	1970	16.0	0.8	43	Tune-up, replaced plugs, pis., air and oil filters 5 Apr 78; salvaged 25 Oct 78.
CA-3231	Truck	Van	Dodge	1972	20.3	9.1	154	Tune-up, replaced air filter 11 Apr 78.
CC-5591	Truck	Van	Ford	1974	18.4	0.9	48	Tune-up 26 June 78.
CC-5593	Truck	Van	Ford	1974	8.9	0.9	64	Tune-up 5 Jul 78.
CE-1296	Truck	Van	Chev	1977	14.5	0.4	435	
CE-1297	Truck	Van	Chev	1977	10.8	0.9	34	
CE-9511	Truck	Van	Dodge	1977	11.6	0.2	60	
OIC-09372	Truck	Van	Dodge	1971	8.9	1.8	453	

TABLE 6a. FT. LEWIS CONTROL VEHICLES (M151)

Reg. Number	Vehicle	Type	Make	Year	Fuel		Tactical		Maintenance Performed
					Economy, mpg	CO%	HC, ppm	HC, ppm	
E-100	Jeep	M-151-A1	Ford	1966	8.9	1.7	830	830	Replaced pis., coil, contact head May 78; tune-up Oct 78.
E-106	Jeep	M-151-A1	Ford	1966	5.3	0.5	149	149	Tune-up, replaced plugs Jun 78; tune-up, replaced dist. Sept 78; tune-up Oct 78.
E-108	Jeep	M-151-A2	AMC	1973	4.8	2.4	84	84	Replaced dist. Jun 78.
E-124	Jeep	M-151-A1	Ford	1968	1.9	2.2	693	693	Replaced cyl. head, plugs, dist. and wires Apr 78; tune-up Jun 78.
E-126	Jeep	M-151-A2	Ford	1971	5.8	3.2	795	795	Replaced carb. Jun 78; replaced carb., adj. valves Sept 78; carb. and valves Oct 78.
E-146	Jeep	M-151-A1	Ford	1967	8.8	0.2	863	863	Replaced plugs and pis. Jul 78; tune-up Sept 78; tune-up Oct 78.
E-150	Jeep	M-151-A1	Ford	1968	4.8	0.7	963	963	Replaced plugs, pis. May 78.
E-162	Jeep	M-151-A2	Ford	1970	2.6	7.5	849	849	Replaced plugs, pis. Jun 78.
E-182	Jeep	M-151-A2	AMC	1973	7.1	1.3	587	587	Tune-up, relaced plugs, pis. Jun 78.
E-186	Jeep	M-151-A2	Ford	1971	14.9	0.7	1740	1740	Tune-up Jun 78; replaced plugs, pis. Sept 78; replaced plugs, repaired dist. Oct 78.
E-190	Jeep	M-151-A1	Ford	1968	11.7	6.1	418	418	Replaced plugs and coil May 78; replaced dist. Jun 78.
E-222	Jeep	M-151-A1	Ford	1966	8.7	0.1	1700	1700	Replaced plugs and coil May 78; replaced dist. Jun 78.
E-242	Jeep	M-151-A2	Ford	1970	1.9	4.3	323	323	Replaced plugs and coil May 78; replaced plugs, pis. and carb. Jun 78.
E-246	Jeep	M-151-A2	Ford	1970	7.7	2.7	133	133	Tune-up Oct 78.
E-250	Jeep	M-151-A2	Ford	1970	13.1	6.6	436	436	Replaced plugs May 78.
E-260	Jeep	M-151-A2	AMC	1973	*	2.2	385	385	Replaced plug Apr 78; replaced plugs May 78; tune-up Jun 78.
E-286	Jeep	M-151-A2	Ford	1971	7.1	3.4	1638	1638	Replaced plugs May 78.
E-288	Jeep	M-151-A2	Ford	1971	5.0	6.2	688	688	Tune-up Jun 78; replaced plugs Sept 78; replaced plugs Oct 78.
E-300	Jeep	M-151-A2	AMC	1973	7.2	0.7	671	671	Tune-up Jun 78; tune-up Sept 78; tune-up Oct 78.
E-308	Jeep	M-151-A2	AMC	1974	4.9	3.3	479	479	Replaced plugs and pis., adj. valves Jun 78.
E-360	Jeep	M-151-A2	AMC	1973	15.5	1.9	1217	1217	Tune-up Jun 78; tune-up Sept 78; tune-up Oct 78.
E-364	Jeep	M-151-A2	AMC	1973	4.7	0.3	820	820	Replaced plugs and pis., adj. valves Jun 78.
E-366	Jeep	M-151-A2	AMC	1973	5.4	2.6	688	688	Tune-up Jun 78; tune-up Sept 78; tune-up Oct 78.

* Data not available or erroneous.

TABLE 6b. FT. LEWIS TEST VEHICLES (M151)

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	Factual		Maintenance Performed
						CO, %	HC, ppm	
E-102	Jeep	M-151-A1	Ford	1966	3.5	0.6	478	Tune-up Oct 78.
E-104	Jeep	M-151-A2	Ford	1971	5.7	2.5	331	Tune-up Sept 78; tune-up Oct 78.
E-120	Jeep	M-151-A2	Ford	1971	3.9	1.8	209	Replaced plugs Jun 78.
E-122	Jeep	M-151-A2	Ford	1971	7.8	0.6	246	Tune-up Jun 78; tune-up Oct 78.
E-128	Jeep	M-151-A2	Ford	1971	5.0	3.0	649	Tune-up Jun 78; tune-up Oct 78.
E-142	Jeep	M151-A2	Ford	1971	14.5	1.1	832	Tune-up Jun 78; tune-up Sept 78; tune-up Oct 78.
E-164	Jeep	M-151-A2	Ford	1970	8.2	2.2	348	Replaced plugs and carb. May 78; replaced pts. and carb. Oct 78.
E-166	Jeep	M-151-A2	Ford	1970	9.9	2.6	233	Tune-up Jun 78.
E-184	Jeep	M-151-A1	Ford	1970	5.2	0.4	359	Replaced plugs, coil, pts. Jun 78.
E-188	Jeep	M-151-A1	Ford	1967	5.7	1.4	221	Replaced plugs, pts., coil and carb. Jun 78.
E-202	Jeep	M-151-A2	Ford	1966	7.2	1.4	600	Replaced head gasket May 78.
E-204	Jeep	M-151-A2	Ford	1971	12.5	0.4	738	
E-220	Jeep	M-151-A1	Ford	1966	*	2.1	198	Replaced pts. and carb. May 78.
E-240	Jeep	M-151-A2	Ford	1970	7.0	1.4	158	Tune-up Jun 78; replaced plugs Sept 78; replaced plugs, pts. Oct 78.
E-248	Jeep	M-151-A2	Ford	1970	4.1	2.6	310	Tune-up Jun 78; replaced carb. Oct 78.
E-252	Jeep	M-151-A2	Ford	1970	6.8	3.0	594	Replaced pts. and coil Jun 78.
E-266	Jeep	M-151-A2	AMC	1973	10.6	4.0	1067	
E-280	Jeep	M-151-A2	Ford	1971	8.3	1.8	436	Replaced plugs, pts. and cond. Apr 78; replaced plugs, dist. May 78; tune-up Oct 78.
E-282	Jeep	M-151-A2	Ford	1971	6.9	1.0	1017	Replaced dist. Jun 78; replaced carb., dist. and plugs Oct 78.
E-284	Jeep	M-151-A2	Ford	1971	7.1	1.1	103	Replaced plugs May 78.
E-306	Jeep	M-151-A1	Ford	1966	9.2	1.1	373	Replaced carb. and dist. Jun 78; tune-up Sept 78; tune-up Oct 78.
E-310	Jeep	M-151-A2	AMC	1973	3.3	3.3	970	Replaced plugs, pts. and coil Jun 78.
E-322	Jeep	M-151-A2	Ford	1966	3.1	1.0	726	Tune-up May 78; replaced plugs, pts. and adj. valves Oct 78.

* Data not available or erroneous.

TABLE 7a. FT. LEWIS CONTROL VEHICLES (M880)

Reg. Number	Vehicle	Type	Make	Year	Fuel		CO, %	HC, ppm	Maintenance Performed
					Economy, mpg	Tactical			
A-131	Truck	M-880	Dodge	1976	9.5	243	2.0	71	Replaced air filter Nov 78.
A-135	Truck	M-880	Dodge	1976	9.1	71	2.4	121	Replaced air filter Nov 78. Salvaged Jan 79.
A-315	Truck	M-880	Dodge	1976	8.6	121	2.1	490	Replaced oil and filter May 78; replaced air filter Jul 78; replaced air filter Nov 78.
A-323	Truck	M-880	Dodge	1976	6.1	490	0.5	72	Replaced air and oil filter and oil Mar 78.
B-111	Truck	M-880	Dodge	1976	6.3	72	0.4	51	PCS Ft. Rucker, Ala. Aug 78.
B-115	Truck	M-880	Dodge	1976	7.1	140	0.2	84	Replaced plugs, air and oil filter and oil Jul 78, PCS Ft. Rucker, Ala. Aug 78.
B-119	Truck	M-880	Dodge	1976	3.5	51	1.7	79	Replaced plugs, air and oil filter and oil Jul 78, PCS Ft. Rucker, Ala. Aug 78.
B-127	Truck	M-880	Dodge	1976	4.3	84	5.2	718	Replaced plug wires Mar 78; cleaned air filter Apr 78. PCS Ft. Rucker, Ala. Aug 78.
B-135	Truck	M-880	Dodge	1976	8.9	79	1.2	174	Cleaned air filter Apr 78; replaced air filter Jul 78. PCS Ft. Rucker, Ala. Aug 78.
B-211	Truck	M-880	Dodge	1976	10.3	718	1.5	426	Replaced air filter Mar 78; replaced plugs Apr 78; replaced air filter May 78. PCS Ft. Rucker, Ala. Aug 78.
B-215	Truck	M-880	Dodge	1976	6.9	174	6.7	70	PCS Ft. Rucker, Ala. Aug 78.
B-223	Truck	M-880	Dodge	1976	8.8	426	6.3	123	Replaced oil filter and oil Mar 78; cleaned/serviced air filter Apr 78. PCS Ft. Rucker, Ala. Aug 78.
B-239	Truck	M-880	Dodge	1976	4.9	70	0.2	148	PCS Ft. Rucker, Ala. Aug 78.
B-311	Truck	M-880	Dodge	1976	13.1	123	3.4	58	Replaced air filter May 78. PCS Ft. Rucker, Ala. Aug 78.
B-315	Truck	M-880	Dodge	1976	2.1	148	7.4	582	Replaced air filter Feb 78. PCS Ft. Rucker, Ala. Aug 78.
B-331	Truck	M-880	Dodge	1976	8.8	58	0.3	74	Replaced air filter Mar 78; replaced oil and filter Jul 78. PCS Ft. Rucker, Ala. Aug 78.
HQ-15	Truck	M-880	Dodge	1977	6.9	582	3.8	24	Replaced plugs, set timing, adj. carb., replaced air, oil and fuel filters Oct 78.
HQ-25	Truck	M-880	Dodge	1976	12.8	74	3.7	205	Replaced air filter Oct 78.
HQ-26	Truck	M-880	Dodge	1976	12.2	24	1.3		Replaced air filter Oct 78.
LH-121	Truck	M-880	Dodge	1976	7.8	205	0.9		Replaced fuel filter Sept 78; replaced oil filter Oct 78.

TABLE 7b. FT. LEWIS TEST VEHICLES (M880)
Tactical

Reg. Number	Vehicle	Type	Make	Year	Fuel Economy, mpg	CO, %	HC, ppm	Maintenance Performed
A-107	Truck	M-880	Dodge	1976	6.2	0.2	98	Replaced fuel filter Sept 78; replaced plugs and wires Nov 78.
A-111	Truck	M-880	Dodge	1976	5.6	0.4	44	Replaced air filter Mar 78; replaced air filter Jul 78.
A-115	Truck	M-880	Dodge	1976	8.8	2.3	176	Cleaned and serviced air filter Apr 78; replaced air and oil filter Oct 78; replaced fuel and air filter Nov 78.
A-139	Truck	M-880	Dodge	1976	5.9	2.0	548	Replaced air filter Jul 78.
A-207	Truck	M-880	Dodge	1976	8.2	0.6	91	Replaced plugs Feb 78.
A-239	Truck	M-880	Dodge	1976	6.2	0.4	53	Replaced air filter May 78.
A-331	Truck	M-880	Dodge	1976	6.3	1.8	459	Replaced air filter Jul 78.
A-335	Truck	M-880	Dodge	1976	7.1	1.1	52	Replaced air filter Feb 78; replaced air filter May 78.
B-107	Truck	M-880	Dodge	1976	9.6	0.3	86	Replaced air filter Apr 78; replaced air filter May 78; PCS Ft. Rucker, Ala. Aug 78.
B-123	Truck	M-880	Dodge	1976	6.9	1.4	656	PCS Ft. Rucker, Ala. Aug 78.
B-131	Truck	M-880	Dodge	1976	7.3	0.4	30	PCS Ft. Rucker, Ala. Aug 78.
B-139	Truck	M-880	Dodge	1976	8.4	0.9	71	Replaced fuel filter Mar 78. PCS Ft. Rucker, Ala. Aug 78.
B-207	Truck	M-880	Dodge	1976	3.4	0.3	752	Replaced oil filter Mar 78; PCS Ft. Rucker, Ala. Aug 78.
B-235	Truck	M-880	Dodge	1976	11.5	0.5	410	Replaced engine Jul 78; PCS Ft. Rucker, Ala. Aug 78.
B-307	Truck	M-880	Dodge	1976	4.7	0.6	70	Replaced oil filter Mar 78; replaced plugs, fuel filter Jul 78; PCS Ft. Rucker, Ala. Aug 78.
B-319	Truck	M-880	Dodge	1976	9.7	1.3	52	Replaced air filter Mar 78; PCS Ft. Rucker, Ala. Aug 78.
B-323	Truck	M-880	Dodge	1976	6.5	1.1	581	PCS Ft. Rucker, Ala. Aug 78.
B-327	Truck	M-880	Dodge	1976	5.8	0.5	98	PCS Ft. Rucker, Ala. Aug 78.
B-335	Truck	M-880	Dodge	1976	15.9	0.2	75	PCS Ft. Rucker, Ala. Aug 78.
B-339	Truck	M-880	Dodge	1976	4.3	0.6	105	PCS Ft. Rucker, Ala. Aug 78.
HQ-23	Truck	M-880	Dodge	1976	7.7	0.9	27	PCS Ft. Rucker, Ala. Aug 78.

TABLE 8. AVERAGE INCREASE/DECREASE IN FUEL ECONOMY AND EMISSIONS
(Test Fleets vs Control Fleets)

Installation	Type Vehicle	Fuel Economy, %		CO, Vol%			Emissions			
		Control, mpg	Test, mpg	Increase	Control	Test	% Decrease	Control	Test	% Decrease
Ft. Sam Houston	Sedans	12.3	13.3	8.1	2.1	0.6	71	174	86	51
	Trucks	9.8	10.4	6.1	2.4	1.0	58	125	125	0
Pine Bluff Arsenal	Sedans	13.3	12.8	-3.8	3.7	1.7	54	363	198	45
	Trucks	8.9	9.6	7.9	2.6	1.0	62	191	125	35
Ft. Lewis	Sedans	13.2	13.8	4.6	1.2	0.6	50	163	100	39
	Trucks	12.7	12.6	-0.8	2.6	1.1	58	217	138	36
	M151	7.2	7.1	-1.4	2.6	1.8	31	746	487	35
	M880*	7.9	7.4	-6.3	2.1	1.0	52	221	165	25
All Nontactical	Sedans	12.7	13.4	5.5	2.1	0.8	62	202	107	47
	Trucks	10.1	10.6	5.0	2.5	1.1	56	173	128	26
All Tactical		7.5	7.2	-4.0	2.5	1.5	40	610	389	36

* Does not include M880's PCS to Ft. Rucker, AL (See Tables 7a and 7b).

mediately apparent that test fleet exhaust emissions were dramatically reduced for both hydrocarbons and carbon monoxide. The single exception to this reduction is for hydrocarbon emissions from trucks at Ft. Sam Houston. The lack of improvement is attributed to the fact that average hydrocarbon emissions for these trucks was already an extremely low 125 ppm for both test and control fleets; there was simply little room for improvement. The remaining emissions results show reductions ranging from 25 to 72 percent of the baseline control fleet averages, indicating obvious potential for enormous reduction in Army fleet exhaust emissions. With the exception of the Ft. Sam Houston trucks, all exhaust emissions reductions were statistically significant as is discussed in Section E. Statistical Analysis.

Fuel economy comparisons ranged from -6.3 percent (control fleet better than test) to +8.1 percent (test fleet better than control). None of these fuel economy comparisons was found to be statistically significant, but there is an indication of potential for improvement when individual vehicle types are considered.

Table 9 categorizes fuel economy and emissions improvement by vehicle make and model for sedans and pickup trucks. These data were not treated statistically, but they serve to illustrate the range of increase or decrease in fuel economy and emissions for specific vehicle types. For the most part, each installation operated several of each vehicle type. As a result, utilization patterns, climatic conditions, etc. varied considerably during this program. For this reason, no make/model advantages should be generalized from these data, but the potential for fuel economy improvement from substandard levels is indicated. Fuel economy data (See Table 8) for tactical vehicles do not reflect this possibility. These vehicles were at times refueled under field conditions where metering systems were not available, requiring driver estimates of fuel added.

E. Statistical Analysis

Test and control fleets for the three basic classes of vehicles (sedans, pickup trucks, and tactical vehicles) were compared statistically for differences in fuel economy (mpg), HC emissions (ppm), and CO emissions (percent). The cumulative t-distribution was used for test vs control fleet comparison of each vehicle class at a given installation. The cumulative

TABLE 9. BREAKDOWN OF FUEL ECONOMY AND EMISSIONS LEVELS
IMPROVEMENT BY VEHICLE MAKE AND YEAR MODEL

Year and Make	No. of Vehicles	Fuel Economy, % Increase	Emissions, % Decrease	
			CO	HC
<u>Sedans</u>				
1971-72 Ford	14	2.8	60	48
1972 AMC	8	12.6	68	34
1973 Chevrolet	19	1.0	38	-6
1975 Ford	4	-2.8	80	29
1976 Ford	5	17.0	18	-4
1977 AMC	21	-13.6	85	58
1977 Ford	10	5.4	57	47
<u>Pickup Truck</u>				
1972 Chevrolet	35	6.0	46	17
1974 Chevrolet	103	6.0	47	17
1976 Dodge	13	3.0	86	44
1977 Dodge	20	-6.0	74	30

F-distribution (one-way Analysis of Variance) was used for installation-to-installation comparisons.

Table 10 presents test vs. control fleet comparisons for nontactical vehicles at the three sites. The cumulative probability, $p=P\{t \leq t_p\}$, i.e. the probability that a calculated t-ratio is significant is given for p 0.90. Otherwise the term "NS" (not significant) is entered. As can be seen, in only one case (Pine Bluff Arsenal) was there a significant change in fuel economy between test and control fleets. In this case, pickup trucks showed a 7.9-percent increase for the test fleet over the control fleet (see Table 8). Otherwise, there were no identifiable differences in fuel economy between test and control fleets at any site. Virtually all exhaust emission comparisons were found to be statistically significant, with test fleets showing much lower HC and CO emissions levels than control fleets. One exception mentioned previously which does not lend itself to statistical analysis is for the truck fleets at Ft. Sam Houston, which had little room for improvement in hydro-

TABLE 10. STATISTICAL COMPARISONS FOR NONTACTICAL VEHICLES
(Test vs Control)

Installation	p ^(a)		
	Fuel Economy	CO	HC
<u>Sedans</u>			
Ft. Lewis	NS	0.90	NS
Ft. Sam Houston	NS	0.995	0.95
Pine Bluff Arsenal	NS	0.90	NS
<u>Trucks</u>			
Ft. Lewis	NS	0.999	0.90
Ft. Sam Houston	NS	0.999	NS
Pine Bluff Arsenal	0.95	0.995 ^(b)	NS
All nontactical:	NS	0.999 ^(b)	0.999 ^(c)

(a) t-statistic: $p = P\{t < t_p\}$

(b) 60% reduction in CO

(c) 33% reduction in HC

carbon emissions. This value, of course, is shown as "not significant." When the three installations are combined for all nontactical vehicles, cumulative probabilities of 0.999 for HC and CO emissions result. These results imply that the respective 33- and 60-percent decrease in emissions for the test fleets compared to the baseline control fleets is indeed a real and general effect. As would be expected, combining fuel economy data for all three installations resulted in no significant effects.

TABLE 11. STATISTICAL COMPARISONS FOR
TACTICAL VEHICLES AT FT. LEWIS, WA
(Test vs Control)

	p ^(a)		
	Fuel Economy	CO	HC
M151	NS	0.975 ^(b)	0.99 ^(c)
M880	NS	0.99 ^(d)	NS ^(e)

Table 11 presents statistical comparisons for the tactical vehicles (M151 and M880) at Ft. Lewis, WA. As with the nontactical fleets, no significant changes in fuel economy were noted. Strong effects for M151 emissions were indicated and for the M880 a large reduction

(a) t-statistic: $p = P\{t < t_p\}$

(b) 33% reduction in CO

(c) 35% reduction in HC

(d) 51% reduction in CO

(e) 25% reduction in HC

effects for M151 emissions were indicated and for the M880 a large reduction

in carbon monoxide (51%) was significant whereas the 25-percent attenuation in hydrocarbon emissions was found not to be statistically significant. This lack of statistical significance is likely due to the limited availability of the vehicles for emission checks throughout the program.

Installation-to-installation comparisons were made by Analysis of Variance techniques only for nontactical vehicles since tactical vehicles were used only at Ft. Lewis. These analyses compared test fleets to one another among the three installations, and likewise compared control fleets. For sedans, no significant differences were found in either fuel economy or HC emissions. Ft. Sam Houston and Ft. Lewis vehicles showed roughly the same characteristics in carbon monoxide emissions attenuation, whereas Pine Bluff Arsenal showed a statistically significant difference in emissions properties. Truck fuel economy was found to vary significantly from installation-to-installation, with Ft. Lewis having best fuel economy followed by Ft. Sam Houston and Pine Bluff Arsenal. This ranking may well account for the previously mentioned fact that fuel economy improvement at Pine Bluff was significant since this installation had the most room for improvement. Truck exhaust emissions variation between installations was not statistically significant.

These similarities and differences between individual vehicle classes at the three installations serve to further support the general observation of dramatically reduced exhaust emissions for test fleets when compared to control fleets whose engines were only tuned during normal scheduled maintenance.

III. CONCLUSIONS

Specific conclusions derived from this program were:

- HC/CO exhaust emissions can be significantly reduced and lower levels of emissions maintained through regular use of exhaust emission analyzers.
- Significant increases in fuel economy may be achievable through periodic use of exhaust emission analyzers if maintenance recommendations as indicated through diagnostic analysis are acted upon.
- Improvement in maintenance posture is difficult, if not impossible, to predict due to discrepancies in record keeping and/or inflexibility in maintenance scheduling/procedures.

IV. RECOMMENDATIONS

As a result of this program, the following recommendations are deemed appropriate:

- Exhaust emission analyzers should be utilized at all TMP maintenance activities as diagnostic tools during regular scheduled maintenance to adjust vehicle engines for the lowest possible emission levels.

- TM 38-750 specifies maintenance activities as follows:

Inspection - Annually or 12,000 miles

Inspection - Semiannually or 6,000 miles

Lubrication - Every 3 months or 4,000 miles

The exhaust emission check should be incorporated into each of the above maintenance requirements.

- This program only addressed the potentiality of exhaust emission reductions through the use of commercial exhaust emission analyzers. These exhaust analyzers only measure tailpipe emissions in the idle mode. As shown in "Update of State Regulations Summary" of this report (see Section V), the state and Federal Standards for vehicle emissions are measured in grams per mile. An emission evaluation should be conducted where Army vehicles are subjected to evaluations on a chassis dynamometer and also with exhaust emission analyzers to determine if the reduced emissions obtained in this program correlate with the state and Federal requirements.

V. TASK II--STATE REGULATIONS SUMMARY

In March 1979, a total of 105 copies of the updated "State Regulations Summary" was forwarded to TARCOM for subsequent distribution to FMT's and appropriate activities where the basic manual is maintained. However, the following is presented to familiarize the reader with the State Regulations Summary portion of the work performed under this contract.

A. Background

During FY1976, AFLRL engineering staff accomplished the initial phases of a program intended to provide U.S. Army technical personnel with current summary information on state and municipal vehicle exhaust emissions regulations, noise regulations, and Inspection and Maintenance programs. Specific actions during this time included:

- Identification of key authorities within each state plus principal municipal areas.
- Personal contact with these authorities to detail Army needs and actions.
- Securing complete state and municipal statutes applicable to this effort.
- Interpretation and condensation of such statutes.
- Compilation of these data in standardized format.
- Data storage in a computer network assessible by TARCOM and (with TARCOM concurrence) other interested Army agencies.
- Coordination of individual summaries with appropriate authorities.
- Publication of finalized data and interpretations in an internal Army document: "State Regulations Summary, Mobile Ground Sources: Emissions-Inspection-Maintenance."

B. Objective

The fundamental objective of this Task was to continually update the summary manual via the existing data retrieval-liaison loop as illustrated in Figure 4.

C. Approach

SwRI staff members previously engaged in the initial manual development work continued this function under this operating contract via already well-established information lines. States listed in Table 12 (page taken from existing "State Regulations Summary, Mobile Ground Sources: Emissions-Maintenance-Inspection" manual) were contacted, their emissions regulations reviewed, manual data upgraded, and any "new" state policies defined. All information was then incorporated in the updated package. In this update, there were 53 state or territorial changes, 52 administrative changes (e.g., personnel replacement), and 20 regulatory changes. Additional examples of material included in the manual are presented in the appendix.

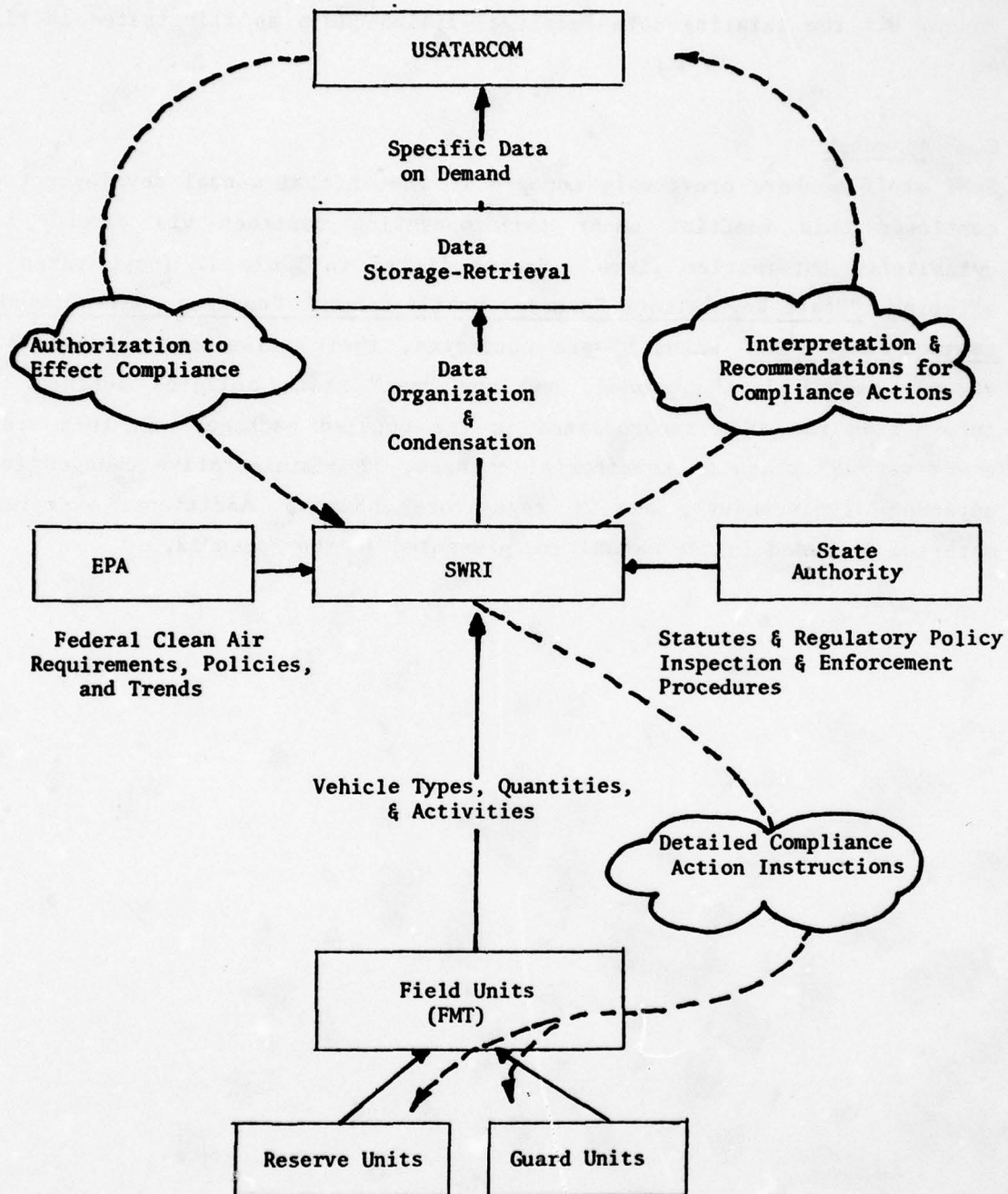


FIGURE 4. INFORMATION AND ACTION FLOW FOR STATE EMISSION REGULATIONS

TABLE 12. STATE INSPECTION AND REGULATIONS SUMMARY

E. P. A. REGIONS	STATES OR TERRITORIES	SMOKE REGS.			INSPECTIONS			FUTURE INSPECTION PROGRAMS	MAINTENANCE REGS.	PENALTIES	NOISE REGS.	ACTIVE COUNTY OR MUNICIPAL PROGRAMS
		G	D	O	G	D	O					
		IV	Alabama	X	X							
X	Alaska	X	X	X								
IX	American Samoa											
IX	Arizona	X	X		X			X	X	X	X	
VI	Arkansas	X	X					X	X	X		
IX	California	X	X		X	X		X	X	X	X	
V	Chicago	X	X		X			X	X	X	X	
V	Cincinnati	X			X			X			X	
VIII	Colorado	X	X					X		X		
I	Connecticut	X	X					X	X	X		
III	Delaware											
III	District of Columbia	X	X					X				
IV	Florida	X	X						X	X		
IV	Georgia	X	X					X			*	
IX	Guam											
IX	Hawaii	X	X					X	X	X		
X	Idaho	X	X					X	X	X		
V	Illinois	X	X					X	X		X	
V	Indiana							X		X		
VII	Iowa	X	X						X	X		
VII	Kansas								X	X		
VII	Kansas City	X	X								X	
IV	Kentucky								X	X		
VI	Louisiana							X				
I	Maine									X		
III	Maryland	X	X					X	X	X		
I	Massachusetts	X	X	X				X		X		
V	Michigan											
V	Minnesota	X	X					X		X		
IV	Mississippi											
VII	Missouri							X		X	X	
VIII	Montana							X	X	X		
VII	Nebraska		X					X	X	X		
IX	Nevada	X	X		X			X		X		
I	New Hampshire	X	X					X		X		
II	New Jersey	X	X		X	X		X		X		
VI	New Mexico		X									
II	New York	X	X		X			X	X			
IV	North Carolina	X	X					X				
VIII	North Dakota	X	X					X				
V	Ohio				X			X			X	
VI	Oklahoma							X				
X	Oregon	X	X		X	X		X	X	X	X	
III	Pennsylvania							X	X	X		
II	Puerto Rico	X	X					X				
I	Rhode Island											
IV	South Carolina											
VIII	South Dakota	X	X					X				
IV	Tennessee											
VI	Texas	X	X					X	X			
VIII	Utah	X	X					X				
I	Vermont	X	X					X		X		
III	Virginia	X	X	X				X	X	**	X	
II	Virgin Islands											
X	Washington	X	X		X			X	X	X		
III	West Virginia							X		X		
V	Wisconsin	X	X					X	X	X		
VIII	Wyoming							X				

G = Gasoline; D = Diesel; O = Other

*Georgia prohibits county or municipal emissions regulations.

**Virginia permits motorcycle noise regulations by county, city, or town.

APPENDIX
Excerpts from "State Regulation Summary,
Mobile Ground Sources: Emissions-Maintenance-Inspection"

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FEDERAL STANDARDS FOR NEW VEHICLE EMISSIONS

LIGHT DUTY GASOLINE & DIESEL VEHICLES

EMISSIONS	1977-1979	1980	1981
HC, G/MILE	1.5	0.41	0.41
CO, G/MILE	15.0	7.0	3.4
NOX, G/MILE	2.0	2.0	1.0
EVAP., G/TEST	2.0	2.0	

LIGHT DUTY GASOLINE & DIESEL TRUCKS

EMISSIONS	GASOLINE AND DIESEL	
	1977-1978	1979
HC, G/MILE	2.0	1.7
CO, G/MILE	20.0	18.0
NOX, G/MILE	3.1	2.3
EVAP., G/TEST	2.0	2.0

HEAVY DUTY GASOLINE & DIESEL ENGINES

EMISSION	1974-1978	1979 AND LATER
CO, G/BHP-HR	40	25
HC-NOX, G/BHP-HR	16	10
OPACITY (DIESEL ONLY), %		
LUG	15	15
ACCELERATION	20	20
PEAK	50	30

FEDERAL STANDARDS--2

MOTORCYCLES

YEAR	ENGINE DISPLACEMENT	EMISSIONS, G/KM*	
		HC	CO
1978-1979	LESS THAN 170 CC	5	17
	170 CC - 750 CC	5-14	17
	ABOVE 750 CC	14	17
1980	ALL	LESS THAN 5	LESS THAN 12

* 5 G/KM IS EQUIVALENT TO 8 G/MI.

NOTE: LIGHT DUTY TRUCK IS 8500 LBS OR LESS
HEAVY DUTY TRUCK IS HEAVIER THAN 8500 LBS.
30SEPT77

FEDERAL NOISE REGULATIONS

AT THE PRESENT TIME, THERE ARE NO FEDERAL VEHICLE NOISE REGULATIONS WHICH APPLY TO THE UNITED STATES ARMY. THE NOISE CONTROL ACT OF 1972 AUTHORIZES ESTABLISHMENT OF FEDERAL NOISE STANDARDS AND DIRECTS ALL FEDERAL AGENCIES TO CARRY OUT PROGRAMS TO PERMIT COMPLIANCE. IT IS ANTICIPATED THAT - IF FEDERAL NOISE REGULATIONS ARE EVER MADE LAW - THEY WILL BE SIMILAR IN NATURE TO THE EPA INTERSTATE COMMERCE CARRIER STANDARDS FOR HIGHWAYS SUMMARIZED BELOW:

MAXIMUM PERMISSIBLE SOUND LEVEL READINGS, DB(A)

HIGHWAY OPERATIONS TEST

MIKE-TO-TARGET MIN.FT MAX.FT		SOFT SITE		HARD SITE	
		35 MI/HR OR LESS	ABOVE 35 MI/HR	35 MI/HR OR LESS	ABOVE 35 MI/HR
35	39	89	93	91	95
39	43	88	92	90	94
43	48	87	91	89	93
48	58	86	90	88	92
58	70	85	89	87	91
70	83	84	88	86	90

STATIONARY TESTS

		SOFT SITE	HARD SITE
		35	39
39	43	88	90
43	48	87	89
48	58	86	88
58	70	85	87
70	83	84	86

1-THE SPEEDS SHOWN REFER TO MEASUREMENTS TAKEN AT SITES HAVING SPEED LIMITS AS INDICATED. THESE SPEED LIMITS DO NOT NECESSARILY HAVE TO BE POSTED

2-THIS TABLE IS BASED ON MOTOR CARRIER NOISE EMISSION REQUIREMENTS SPECIFIED IN 40 CFR 202.20 AND 40 CFR 202.21

FEDERAL NOISE--2

IN ADDITION, THE EPA STANDARDS FOR NEW MEDIUM AND NEW HEAVY DUTY TRUCKS (OVER 10,000 LB GVWR--EITHER CLASS) ARE:

EFFECTIVE DATE	LEVEL, DB(A)
1 JAN 78	83
1 JAN 82	80
1 JAN 85	(RESERVED)

PROPOSED NOISE EMISSION STANDARDS FOR MOTORCYCLES:

STREET MOTORCYCLES

1 JAN 80	83
1 JAN 82	80
1 JAN 85	78

MOPED-TYPE STREET MOTORCYCLES:

1 JAN 80	70
----------	----

OFF-ROAD MOTORCYCLES, ENGINES
170 CC AND BELOW:

1 JAN 80	83
1 JAN 82	80
1 JAN 85	78

OFF-ROAD MOTORCYCLES, ENGINES
LARGER THAN 170 CC:

1 JAN 80	86
1 JAN 83	82

22JAN79

- REFERENCE: 1. TITLE 40, CODE OF FEDERAL REGULATIONS CHAPTER 1, PART 202, 39 FR 38208, OCTOBER 29, 1974
2. PL 92-574; ENACTED BY CONGRESS OCTOBER 18, 1972; SIGNED BY THE PRESIDENT OCTOBER 27, 1972
3. TITLE 49, CODE OF FEDERAL REGULATIONS CHAPTER 11, PART 325, 40 FR 42437, SEPTEMBER 12, 1975

3MAY76

ARIZONA

1. AGENCIES

A. EPA REGION IX
13AUG75

REGIONAL ADMINISTRATOR:
PAUL DEFALCO, JR.; (415) 556-2320; 100 CALIFORNIA ST.,
SAN FRANCISCO, CA. 94111.
13AUG75

B. STATE

BUREAU OF VEHICLE EMISSIONS INSPECTION, CHIEF: R. FRED
IACOBELLI; (602) 255-1167, 600 N. 40TH ST., PHOENIX,
AZ 85008
29DEC78

C. COUNTY OR DISTRICT

2. SOURCE

ARIZONA RULES AND REGULATIONS FOR POLLUTION CONTROL, REGULATION
R9-3-1000, AND AIR POLLUTION CONTROL LAW, TITLE 36, CHAPTER 14.
13AUG75

3. VISIBLE EMISSIONS

A. GASOLINE POWERED

VISIBLE, 10-SECOND MAXIMUM.
13AUG75

B. DIESEL POWERED

NO. 1 RINGELMANN OR 20% OPACITY, 10-SECOND MAXIMUM
29DEC78

C. OTHER

4. EMISSION INSPECTION STANDARDS

A. GASOLINE POWERED

(MAXIMUM ALLOWABLE)
ALL HC VALUES MEASURED AS N-HEXANE

TYPE- VEHICLE YR., WEIGHT (LBS), NO. CYLINDERS	HIGH CRUISE		LOW CRUISE		IDLE MODE	
	HC PPM	CO %	HC PPM	CO %	HC PPM	CO %
4 STROKE MOTORCYCLES, ALL	700	8.6			2,000	9.0
4 STROKE- 1975 & NEWER 6000 OR LESS, 4 CYLINDERS OR LESS	100	0.9	120	1.0	250	3.3

ARIZONA--2

4 STROKE- 1975 & NEWER 6000 OR LESS, MORE THAN 4 CYLINDERS	100	0.9	120	1.0	250	3.3
4 STROKE- 1975 & NEWER GREATER THAN 6000, ALL	300	2.5	300	3.0	400	7.0
4 STROKE- 1972-1974, ALL, 4 CYLINDERS OR LESS	380	3.0	380	3.5	450	7.2
4 STROKE- 1972-1974, ALL, MORE THAN 4 CYLINDERS	300	2.5	300	3.0	400	7.0
4 STROKE- 1968-1971, ALL, 4 CYLINDERS OR LESS	450	3.75	450	4.25	850	8.0
4 STROKE- 1968-1971, ALL, MORE THAN 4 CYLINDERS	380	3.0	380	3.5	750	8.0
4 STROKE- 1967 & OLDER, ALL, 4 CYL. OR LESS	1000	5.0	1000	6.0	2000	9.5
4 STROKE- 1967 & OLDER, ALL, MORE THAN 4 CYLINDERS	700	4.25	700	5.25	1500	9.5

(MEASURED AS PROPANE EQUIVALENT GAS)

2 STROKE- ALL	23000	8.0	18000	6.0
---------------	-------	-----	-------	-----

* LOW CRUISE STANDARD WILL BE SUBSTITUTED FOR HIGH CRUISE STANDARD AND LOW CRUISE WILL BE ELIMINATED IF THE VEHICLE WEIGHS LESS THAN 2000 POUNDS CURB WEIGHT.

ARIZONA VEHICLE-IN-USE INSPECTION TEST: AVERAGE HC AND CO TAKEN AT 50 MPH, 30 MPH, AND IDLE (CHASSIS DYNAMOMETER USED)
1. ENGINE AT NORMAL OPERATING CONDITIONS AND LEVEL.

2. IDLE MODE WITH TRANSMISSION IN GEAR, CLUTCH DISENGAGED WITH STANDARD TRANSMISSIONS.

3. VEHICLES WITH TRANSMISSIONS SHALL BE TESTED:

A. ALL TEST CONDITIONS RUN WITH TRANSMISSION IN DRIVE

B. IDLE MODE RUN WITH TRANSMISSION IN DRIVE WHEELS BRAKED.

PENALTIES: LICENSE PLATES WITHHELD UNTIL VEHICLE PASSES INSPECTION, EFFECTIVE JAN. 1, 1977

29DEC78

B. DIESEL POWERED

C. OTHER

5. MAINTENANCE

THIRTY DAY GRACE PERIOD FOR CORRECTION OF DEFECTS OBSERVED DURING INSPECTION.

29DEC78

ARIZONA--3

6. EXEMPTIONS

- A. COLD ENGINE START-UP EMISSIONS.
 - B. OFF-HIGHWAY DIESEL-POWERED VEHICLES
 - C. FLEET OPERATORS IF PERFORMING OWN INSPECTIONS (IDLE ONLY)
 - D. VEHICLES OVER 13 YEARS OLD
- 29DEC78

7. VEHICLE NOISE

- A. MUFFLERS IN GOOD WORKING CONDITION AT ALL TIMES
 - B. NO CUTOOTS, BYPASSES, ETC.
 - C. BOATS: 86 DB/50 FT; NO EXCESSIVE OR UNUSUAL NOISES
 - D. EXCEPTIONS: SANCTIONED COMPETITIONS OR TIME TRIALS
- 13AUG75

8. REMARKS

MANDATORY INSPECTION JAN. 1, 1976; MANDATORY COMPLIANCE
JAN. 1, 1977 (APPLIES TO COUNTIES WITH MORE THAN 350,000 POPULATION)
THIS INCLUDES ONLY MARICOPA-PHOENIX AND PIMA-TUCSON COUNTIES

13AUG75

9. DATE OF LAST REVISION:
29DEC78

CALIFORNIA

1. AGENCIES

A. EPA REGION IX
2SEPT75

REGIONAL ADMINISTRATOR:
PAUL DEFALCO, JR.; (415) 556-2320; 215 FREMONT,
SAN FRANCISCO, CA 94105
17JAN79

B. STATE

CALIFORNIA AIR RESOURCES BOARD, CHAIRMAN: THOMAS C. AUSTIN;
(916) 322-5840; 1709 11TH ST., SACRAMENTO, CA 95814
17JAN79

C. COUNTY OR DISTRICT

2. SOURCE

CALIFORNIA ADMINISTRATIVE CODE, TITLE 13, MOTOR VEHICLES,
CHAPTER 3: AUTOMOTIVE EXHAUST EMISSION AND DIESEL EMISSION
STANDARDS; DIVISION 12, CHAPTER 5, ARTICLE 2, SECTIONS 27150
AND CHAPTER 1, SECTIONS 24007.
17JAN79

3. VISIBLE EMISSIONS

A. GASOLINE POWERED

1. JAN. 1, 1971 OR PRIOR VEHICLES, LESS THAN 4000 FT: NO. 2
RINGELMANN OR 40% OPACITY, 10-SECONDS MAXIMUM
2. JAN. 1, 1971 OR AFTER VEHICLES, LESS THAN 4000 FT: NO. 1
RINGELMANN OR 20% OPACITY, 10-SECONDS MAXIMUM
2SEPT75

B. DIESEL POWERED

1. JAN. 1, 1971 OR PRIOR VEHICLES, LESS THAN 4000 FT: NO. 2
RINGELMANN OR 40% OPACITY, 10-SECONDS MAXIMUM
2. JAN. 1, 1971 OR AFTER VEHICLES, LESS THAN 4000 FT: NO. 1
RINGELMANN OR 20% OPACITY, 10-SECONDS MAXIMUM
2SEPT75

C. OTHER

EVAPORATIVE EMISSIONS OF HYDROCARBONS:

1. LIGHT-DUTY VEHICLES 1970 TO 1972: 6 GMS/TEST BY CARBON TRAP
TEST PROCEDURE.
2. LIGHT-DUTY VEHICLES 1972 TO 1977: 2 GMS/TEST BY CARBON TRAP
TEST PROCEDURE.
3. LIGHT-DUTY VEHICLES 1979: 6 GMS/TEST BY THE SEALED HOUSING
FOR EVAPORATIVE DETERMINATIONS TEST PROCEDURE.
4. ALL MODEL VEHICLES 1980: 2 GMS/ TEST BY THE SEALED HOUSING
FOR EVAPORATIVE DETERMINATIONS TEST PROCEDURE.

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5. HEAVY-DUTY GASOLINE-POWERED VEHICLES: 2 GMS/TEST BY ENGINEERING EVALUATION.

6. AUXILIARY FUEL TANKS 1974; NO DEGRADATION IN EMISSIONS CONTROL 27SEPT77

4. EMISSION INSPECTION STANDARDS

A. GASOLINE POWERED

PASSENGER CARS AND LIGHT-DUTY TRUCKS

YEAR	COLD START TEST	HYDROCARBONS	CARBON MONOXIDE	OXIDES OF NITROGEN
PRIOR TO CONTROLS	7-MODE	850 PPM	3.4%	1000 PPM
	7-MODE	11GM/MI	80 GM/MI	4 GM/MI
	CVS-75	8.8 GM/MI	67 GM/MI	3.6 GM/MI
1966-1967	7-MODE	275 PPM	1.5 %	NO STD
1968-1969	7-MODE			
	50-100 CID	410 PPM	2.3 %	NO STD
	101-140 CID	350 PPM	2.0 %	NO STD
	OVER-140 CID	275 PPM	1.5 %	NO STD
1970	7-MODE	2.2 GM/MI	23 GM/MI	NO STD
1971	7-MODE	2.2 GM/MI	23 GM/MI	4 GM/MI
1972	7-MODE	1.5 GM/MI	23 GM/MI	3 GM/MI
	CVS-72	3.2 GM/MI	39 GM/MI	*3.2 GM/MI
1973	CVS-72	3.2 GM/MI	39 GM/MI	3 GM/MI
1974	CVS-72	3.2 GM/MI	39 GM/MI	2 GM/MI

PASSENGER CARS AND LIGHT-DUTY TRUCKS HAVE THE SAME STANDARDS THROUGH 1974.

1975	PC+	CVS-75	0.9 GM/MI	9 GM/MI	2 GM/MI
	LDT+	CVS-75	2.0 GM/MI	20 GM/MI	2 GM/MI
1976	PC	CVS-75	0.9 GM/MI	9 GM/MI	2 GM/MI
	LDT	CVS-75	0.9 GM/MI	17 GM/MI	2 GM/MI
1977	PC	CVS-75	0.41 GM/MI	9.0 GM/MI	1.5 GM/MI
	LDT	CVS-75	0.9 GM/MI	17 GM/MI	2 GM/MI
1978	PC	CVS-75	0.41 GM/MI	9 GM/MI	1.5 GM/MI
	LDT	CVS-75	0.9 GM/MI	17 GM/MI	2 GM/MI
1979	PC	CVS-75	0.41 GM/MI	9 GM/MI	1.5 GM/MI
	LDT	CVS-75	0.5 GM/MI	9 GM/MI	2 GM/MI

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			NON-METHANE HYDROCARBONS		
1980	PC	CVS-75	0.39 GM/MI	9.0 GM/MI	1.0 GM/MI
	LDT	CVS-75	0.50 GM/MI	9.0 GM/MI	2.0 GM/MI
1981	PC	CVS-75	0.41 GM/MI	3.4 GM/MI	1.0 GM/MI
	LDT	CVS-75	0.50 GM/MI	9.0 GM/MI	1.5 GM/MI
1982	PC	CVS-75	0.39 GM/MI	7.0 GM/MI	0.4 GM/MI
	LDT	CVS-75	0.50 GM/MI	9.0 GM/MI	1.5 GM/MI
1983& LATER	PC	CVS-75	0.39 GM/MI	7.0 GM/MI	0.4 GM/MI
	LDT	CVS-75	0.50 GM/MI	9.0 GM/MI	1.0 GM/MI

GM/MI=GRAMS PER MILE
 7-MODE=IS A 137 SECOND DRIVING CYCLE TEST.
 CVS-72=IS A CONSTANT VOLUME SAMPLE COLD START TEST.
 CVS-75=IS A CONSTANT VOLUME SAMPLE TEST WHICH INCLUDES COLD AND
 HOT STARTS.
 *=HOT 7-MODE
 +=PC-PASSENGER CARS; LDT-LIGHT DUTY TRUCKS (UP TO 6000 LBS.)
 17JAN79

HIGHWAY AND MANDATORY INSPECTION EMISSION STANDARDS

HIGHWAY EXHAUST EMISSION: LIGHT-DUTY VEHICLES. THE EXHAUST
 EMISSION STANDARDS BELOW ARE THE MAXIMUM ALLOWABLE. THE
 INSPECTION SHALL CONSIST OF EMISSION MEASUREMENT FROM A HOT
 IDLING ENGINE WITH THE TRANSMISSION SET IN NEUTRAL.

VEHICLE MODEL-YEAR	NO. OF CYLINDERS	HYDROCARBONS PPM HEXANE BY VOLUME+		CARBON MONOXIDE PERCENT BY VOLUME+	
		AI#	OTHERS*	AI#	OTHERS*
1955-1965	4 OR LESS	1900		8.0	
	5 OR MORE	1200		8.0	
1966-1967	4 OR LESS	1900		8.0	
	5 OR MORE	400	500	5.5	7.0
1968-1970	4 OR LESS	500	650	5.5	7.0
	5 OR MORE	400	500	5.5	7.0
1971&LATER	4 OR LESS	450	600	3.5	5.0
	5 OR MORE	250	350	3.0	4.0

+ AS MEASURED BY A NONDISPERSIVE INFRARED INSTRUMENT.
 # AIR INJECTION EMISSION CONTROL SYSTEM.
 * OTHER REFERS TO VEHICLES NOT EQUIPPED WITH AIR INJECTION
 SYSTEMS.

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MEDIUM-DUTY VEHICLES 8500 LBS OR LESS

YEAR		COLD START TEST	HYDROCARBON	CARBON MONOXIDE	OXIDES OF NITROGEN
1969-77	SEE HEAVY-DUTY STANDARDS FOR 1969-1977				
1978	GAS. & DIESEL	CVS-75	(0.90 GM/MI)	(17 GM/MI)	(2.3 GM/MI)
1979	GAS. & DIESEL	CVS-75	(0.90 GM/MI)	(17 GM/MI)	(2.3 GM/MI)
1980	GAS. & DIESEL	CVS-75	(0.90 GM/MI)	(17 GM/MI)	(2.3 GM/MI)
1981	GAS. & DIESEL	CVS-75	(0.60 GM/MI)	(9 GM/MI)	(2.0 GM/MI)
1982	GAS. & DIESEL	CVS-75	(0.60 GM/MI)	(9 GM/MI)	(2.0 GM/MI)
1983 & LATER 17JAN79	GAS. & DIESEL	CVS-75	(0.60 GM/MI)	(9 GM/MI)	(1.5 GM/MI)

B. DIESEL POWERED

HEAVY-DUTY GASOLINE AND DIESEL VEHICLES OVER 6000 LBS. GVW

YEAR	STANDARD	HYDROCARBONS	CARBON MONOXIDE	OXIDES OF NITROGEN
1969-1971	GASOLINE	275 PPM	1.5%	NO STD
1972	GASOLINE	180 PPM	1.0%	NO STD
1973-1974	GASOLINE & DIESEL	HC + NOX = 16 GM/BHP HR; 40 GM/BHP HR		CO =
1975-1976	GASOLINE & DIESEL	HC + NOX = 10 GM/BHP HR; 30 GM/BHP HR		CO =
1977	GASOLINE & DIESEL	HC + NOX = 5 GM/BHP HR; 25 GM/BHP HR		CO =
1978	GASOLINE & DIESEL	HC + NOX = 5 GM/BHP HR; 25 GM/BHP HR		CO =
1979	GASOLINE & DIESEL	HC + NOX = 5 GM/BHP HR; 25 GM/BHP HR		CO =
1980-1982	GASOLINE & DIESEL	HC + NOX = 5 GM/BHP HR; 25 GM/BHP HR		CO =

12. OFF-ROAD UTILITY VEHICLES BUILT BETWEEN JAN. 1 THROUGH APRIL 30, 1970 ARE EXEMPT FROM EVAPORATIVE EMISSIONS
27SEPT77

7. VEHICLE NOISE

- A. ADEQUATE MUFFLER IN CONSTANT OPERATION; NO CUTOUTS, BYPASSES OR MODIFICATIONS INCREASING SMOKE
- B. NOISE STANDARDS (ALL VALUES DB(A), 50 FT. FROM CENTER OF TRAVEL LANE OR FROM BOAT):

VEHICLE TYPE	SPEED LIMIT 35 MPH OR LESS		SPEED LIMIT OVER 35 MPH
	GRADE OVER +OR- 1%	GRADE WITHIN +OR- 1%	
1. OVER 5999 LB GVW	86	82	90
2. MOTORCYCLES	82	77	86
3. ALL OTHER VEHICLES	76	74	82
	MFG BEFORE 1/76	MFG 1/76 TO 1/78	MFG AFTER 1/78
4. MOTORBOATS	86	84	82

- C. HIGHWAY PATROL EXHAUST SYSTEM TEST PROCEDURE FOR PASSENGER CARS AND VEHICLES (OTHER THAN MOTORCYCLES) G.V.W. LESS THAN 6,000 LBS.
 - 1. EXHAUST NOISE 95 DB(A) OR LESS, 20 INCHES FROM EXHAUST OUTLET AT 45 DEGREES (NORMAL ENGINE RUNNING TEMPERATURE WITH TRANSMISSION IN NEUTRAL.
 - 2. VEHICLES MFG. AFTER 1967 MAY EXCEED 95 DB(A) IF REPLACEMENT PARTS ARE NOT LOUDER THAN ORIGINAL EQUIPMENT.
 - 3. MOTORCYCLES AND HEAVY TRUCKS WILL BE COVERED AT A LATER DATE
- D. NEW VEHICLES MUST SATISFY CALIFORNIA VEHICLE CODE, SECTION 27160 (TOO DETAILED TO INCLUDE) FOR REGISTRATION
- E. PENALTIES: MISDEMEANOR
- F. EXEMPTIONS:
 - 1. VEHICLES WITH AT LEAST 2 SNOW TIRES
 - 2. SANCTIONED RACING VEHICLES WHILE ON TRACK
 - 3. OFFROAD VEHICLES

30APR76

8. REMARKS

EARLY IN 1979, A MANDATORY VEHICLE INSPECTION PROGRAM WILL BEGIN ON A CHANGE OF OWNERSHIP BASIS FOR LIGHT AND MEDIUM-DUTY VEHICLES. SEVENTEEN STATIONS WILL BE BUILT IN THE SOUTH COAST AIR SHED. THE INSPECTION WILL CONSIST OF AN IDLE EMISSIONS TEST, A SMOKE CHECK, AND A VISUAL CHECK OF EMISSION CONTROL DEVICES. LEGISLATIVE CHANGES ARE REQUIRED TO CHANGE THIS TO AN ANNUAL INSPECTION PROGRAM.
17JAN79

9. DATE OF LAST REVISION:
17JAN79