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EFFECT OF PRECONDITIONING ON IN-USE VEHICLE TESTING AND FAILURE ANALYSIS OF EVAPORATIVE EMISSION CONTROL SYSTEMS

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Mobile Source Air Pollution Control
Emission Control Technology Division
Ann Arbor, Michigan 48105

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by

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Task Order No. 3

EPA Task Officer: Gary M. Wilson

Prepared for

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Foreword

Assessment of vehicle emissions in the in-use vehicle population depends upon a reliable and repeatable test procedure. This task order was initiated to investigate the effect of various preconditioning techniques on evaporative and exhaust emissions. This information will be useful in determining the appropriate test procedure for use in emission-factor test programs.

ABSTRACT

Evaporative (SHED) and exhaust emission tests were performed on 20 late-model catalyst-equipped vehicles to investigate the effect of three preconditioning procedures consisting of: 1) no preconditioning, 2) 1975 FTP driving schedule, and 3) 10-minute road route. A failure analysis was also performed on several vehicles which were found to either have high evaporative emissions or evaporative emissions which were higher than similarly equipped vehicles.

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Section 1

INTRODUCTION AND SUMMARY

This final report is submitted by Olson Laboratories, Inc., to the Environmental Protection Agency (EPA), to document the conduct and findings of Task Order 3 of Contract No. 68-03-2412.

This task order was originally divided into two separate parts: A) effect of different preconditioning procedures on exhaust and evaporative emissions, and B) failure analysis of failed evaporative emission control systems. For Part A, 20 vehicles were each tested 3 times in accordance with the Federal Register dated August 23, 1976, entitled Final Evaporative Emission Regulations for Light-Duty Vehicles and Trucks (the SHED procedure). Different preconditioning, however, was used prior to each of the three test sequences. Data, in punched card format defined by the EPA, has been submitted to the EPA Project Officer.

Of the 20 vehicles tested, 10 high emitters were to have been selected for a failure analysis. However, all 1977 vehicles were generally within the expected evaporative emission levels (4 grams per diurnal test and 6 grams per hot soak test). Those vehicles which showed high emission levels were equipped with evaporative emission controls which were not designed to control evaporative emissions as measured by the SHED procedure. None of the systems exhibited defective components which were correctible by repair or replacement with OEM components.

In general, the 1975 Federal Test Procedure (FTP) exhaust emissions did not significantly depend upon preconditioning prior to testing. Evaporative emissions, however, did depend upon preconditioning with "as received" vehicles typically showing higher evaporative emissions than either dynamometer (1975 FTP driving schedule) or road (10-minute city street route used in Emission Factor Test Programs) preconditioning. There were no significant differences in evaporative emissions between the dynamometer or road preconditioning. Diurnal evaporative emissions, however, were considerably more sensitive to lack of preconditioning than were hot soak emissions.

Section 2

CONCLUSIONS

The following conclusions were based on this project:

- The evaporative emission control systems representative of 1978 model-year systems were within the 6 grams per test standard effective with the 1978 model-year.
- There were no significant differences in either evaporative or exhaust emissions at the 95 percent confidence level between dynamometer (1975 FTP) and road preconditioning (10-minute road route).
- There were no significant differences in exhaust emissions at the 95 percent confidence level between no-preconditioning and either dynamometer or road preconditioning.
- No-preconditioning did result in statistically higher evaporative emissions at the 95 percent confidence level than either dynamometer or road preconditioning.
- Evaporative emissions from vehicles which have not been preconditioned were not clearly related to the quantity of fuel in the fuel tank, or the duration and type of drive to the test laboratory.

Section 3

METHODOLOGY

This section summarizes the methodology applied to vehicle procurement, testing, and data reduction.

3.1 VEHICLE SELECTION AND PROCUREMENT

The 20 vehicles shown in Table 3-1 were selected by the Task Officer for testing on this project. These vehicles were believed to be capable of meeting 1978 evaporative emission standards of 6 grams per test. They were consumer-owned vehicles except that one leased vehicle (#3021) was used as a correlation vehicle between Olson's Anaheim laboratory and the California Air Resources Board (ARB) laboratory in El Monte, California.

The consumer-owned vehicles were obtained from prior participants (pre-1977 model-year) and from respondents to direct mail solicitation (1977 model-year) derived from vehicle registration listings.

The incentive package for participants included the following:

- o Free fully-insured 1976 Ford Granada loan vehicle.
- o Full tank of gas when participant's vehicle was returned.
- o Cash or check for $15 each time the owner delivered the vehicle to Olson. In the event of an aborted or invalid test which required preconditioning by the owner, an additional $15 was paid.
- o $50 savings bond upon completion of all testing and return of the vehicle to its owner.

Upon initial arrival at Olson, the Vehicle Information Form, and vehicle owner questionnaire used in the 1975 Emission Factor Test Program, were completed by the participant. The following data (shown in the Appendix) were also recorded as part of the questionnaire when the vehicle was driven to Olson.

- o Odometer reading at start and end of drive to Olson test facility.
- o Amount of fuel in tank at start of initial cold soak.
- o Time of day and ambient temperature in the shade when the vehicle was initially driven to Olson.
- o Type of fuel evaporative emission controls.

Table 3-1. VEHICLES SELECTED FOR TESTING
Task Order 3 - Contract 68-03-2412

VEHICLE NUMBER	MODEL YEAR	ENGINE SIZE Cid	Cyl	Carb	ENGINE FAMILY	MAKE
3001	1977	225	6	1	CD-225-1-EP	Plymouth
3002	1977	225	6	1	CD-225-1-EP	Plymouth
3003	1977	360	8	4	CD-360-4-GP	Dodge
3004	1977	360	8	4	CD-360-4-GP	Chrysler
3005	1977	360	8	4	CD-360-4-GP	Dodge
3006	1977	360	8	4	CD-360-4-GP	Dodge
3007	1977	140	4	2	710 C2	Vega
3008	1977	140	4	2	710 C2	Vega
3009	1977	151	4	2	720X 2E	Astre
3010	1977	151	4	2	720X 2E	Astre
3011	1977	168	6	FI	L-280-C	Datsun 280Z
3012*	1977	168	6	FI	L-280-C	Datsun 280Z
3013	1977	231	6	2	740E 2LU	Cutlass
3014	1976	250	6	1	250-1CEF	Maverick
3015	1976	250	6	1	250-1CEF	Maverick
3016	1976	140	4	2	11 C2	Vega
3017	1976	140	4	2	11 C2	Vega
3018	1975	350	8	4	31 J43	Oldsmobile
3019	1975	350	8	4	31 J43	Oldsmobile
3020	1976	97	4	FI	2	VW Beetle
3021	1976	302	8	2	302A-1CEF	Granada

*Task Officer allowed substitution of vehicle 3021 for one Datsun 280Z.

3.2 VEHICLE TEST SEQUENCE

Figure 3-1 summarizes the flow path of each vehicle during testing. Figure 3-2 shows, in detail, the elements of the Evaporative/Exhaust Emission Test. Separate paragraphs discuss the following elements of the test sequence:

- Vehicle preconditioning
- Evaporative emission tests
- FTP exhaust emission tests
- Quality assurance procedures

3.2.1 Vehicle Preconditioning

Vehicle preconditioning was performed as follows:

- Preconditioning for the initial test sequence was the vehicle owner's drive to Olson. The vehicle was driven to the soak area after a short (less than 30 minutes) engine-off period during which the vehicle was accepted into the program. The vehicles could not always be driven immediately into soak because of interfering with tests in progress.

- Preconditioning for the second test sequence was the first emission test; i.e., a 1975 FTP driving schedule. The vehicle was pushed from the SHED into the soak area after completion of the first hot soak test.

- Preconditioning for the third test was the 10-minute road route (see Appendix) used for Emission Factors Test Programs. The vehicle was driven out of the SHED after the second hot soak test, preconditioned and driven to the soak area.

- Preconditioning for the tests performed as part of the failure analyses was a UDDS (LA-4) dynamometer cycle. The vehicle was driven to the soak area.

All vehicles were in the soak area for 12 to 36 hours at temperatures between 68°F ~~(15°C)~~ 20°C and 86°F (30°C).

3.2.2 Evaporative Emission Tests

Evaporative emission tests were performed in accordance with 40 CFR 86.133-78 for the diurnal loss test and 40 CFR 86.138-78 for the hot soak test. A Horiba Model V SHED, modified to include a water-chilled heat exchanger, was used in this program. Figures 3-3 and 3-4 show the SHED. Figures 3-5 and 3-6 show the instruments for recording hydrocarbons (Scott Model 116 FID), fuel temperature, and SHED temperature. Fuel temperature was measured using Type-J thermocouples inserted through an OEM replacement test cap. The inner and outer penetration of the cap was sealed with a quick-setting epoxy. SHED temperatures were recorded using thermistors.

Vehicle fuel systems were initially pressure tested prior to the first test. The pressure test consisted of applying 14 to 15 inches of water pressure to the fuel system through the fuel tank vapor line leading into the carbon

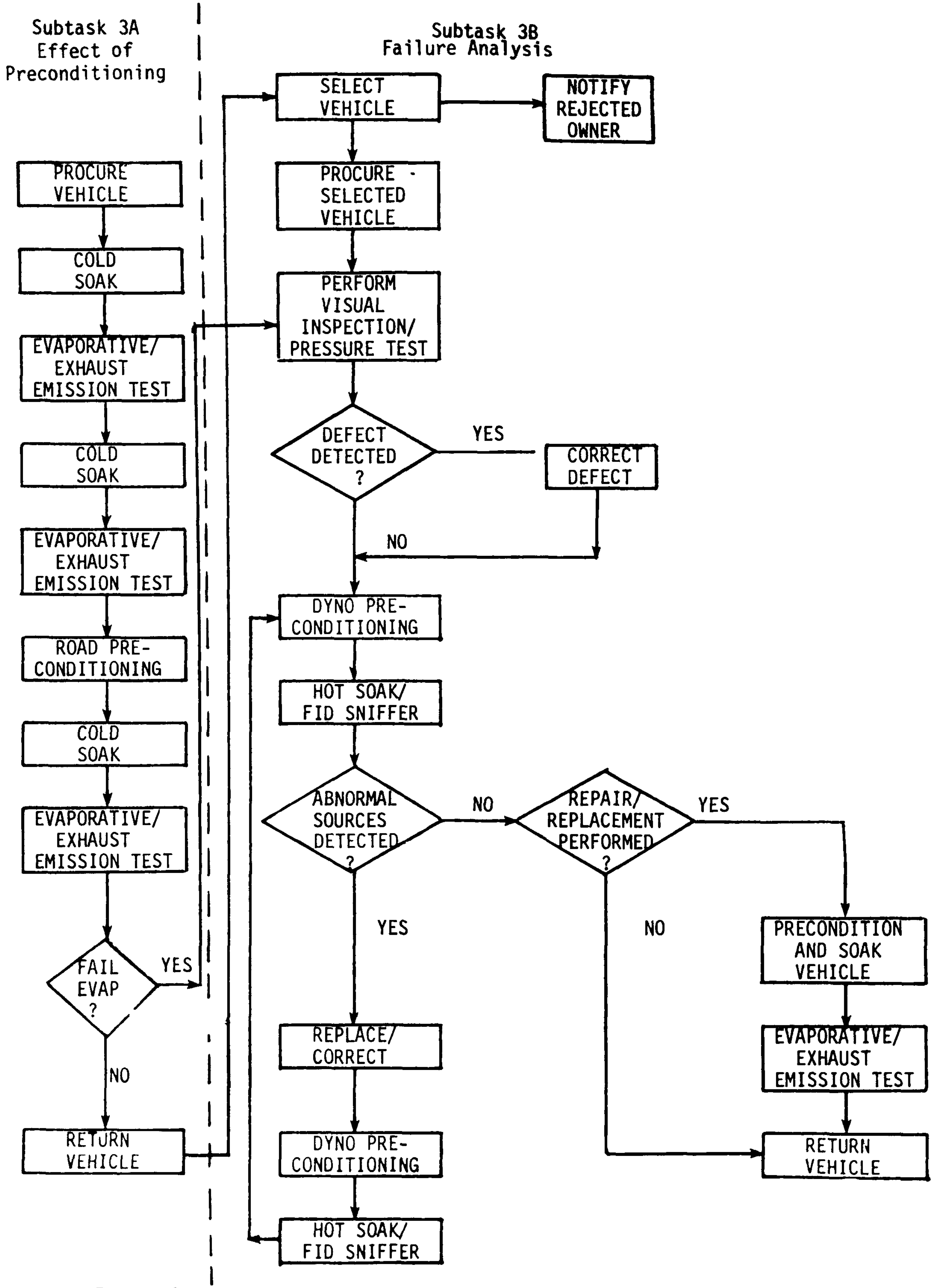


Figure 3-1. VEHICLE FLOWCHART (EPA Contract 68-03-2412 - Task Order 3)

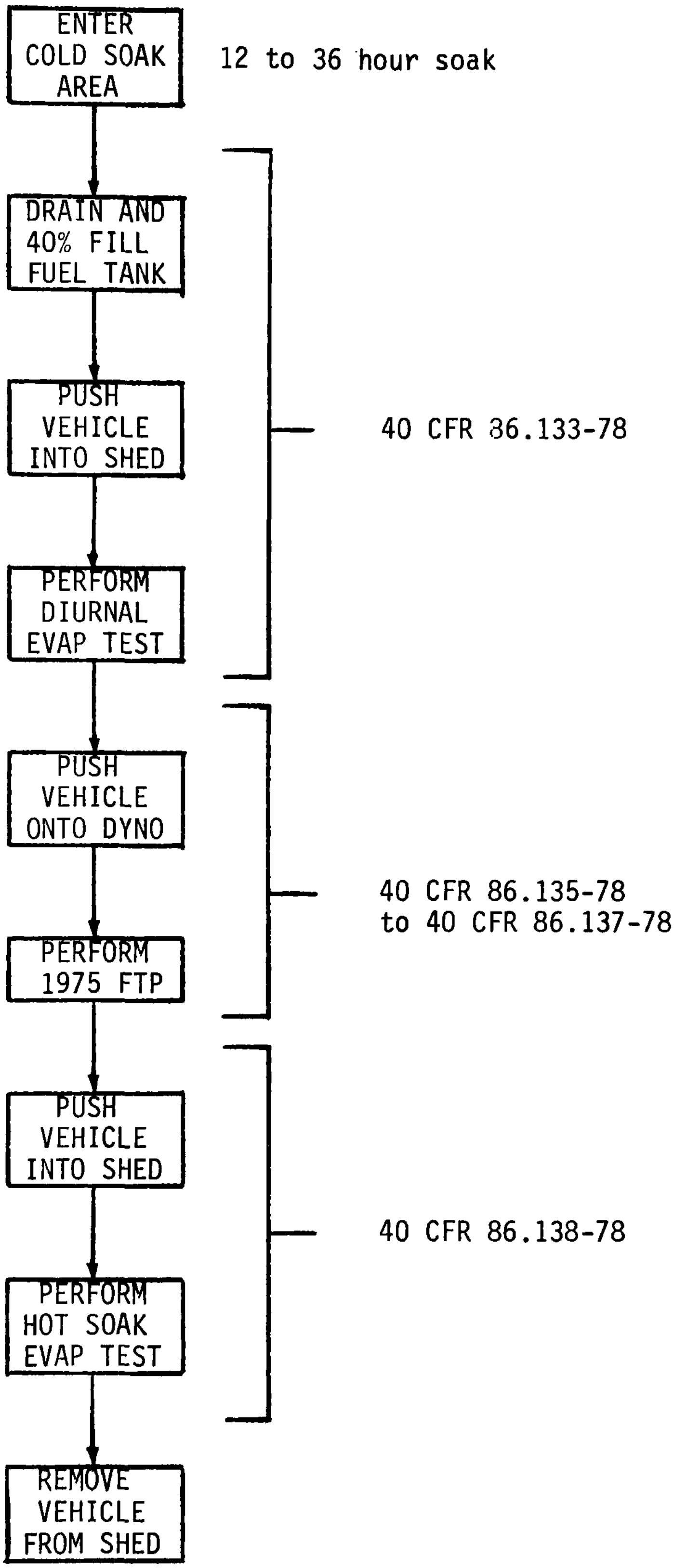


Figure 3-2. EVAPORATIVE/EXHAUST EMISSION TEST
(EPA Contract 68-03-2412 - Task Order 3)

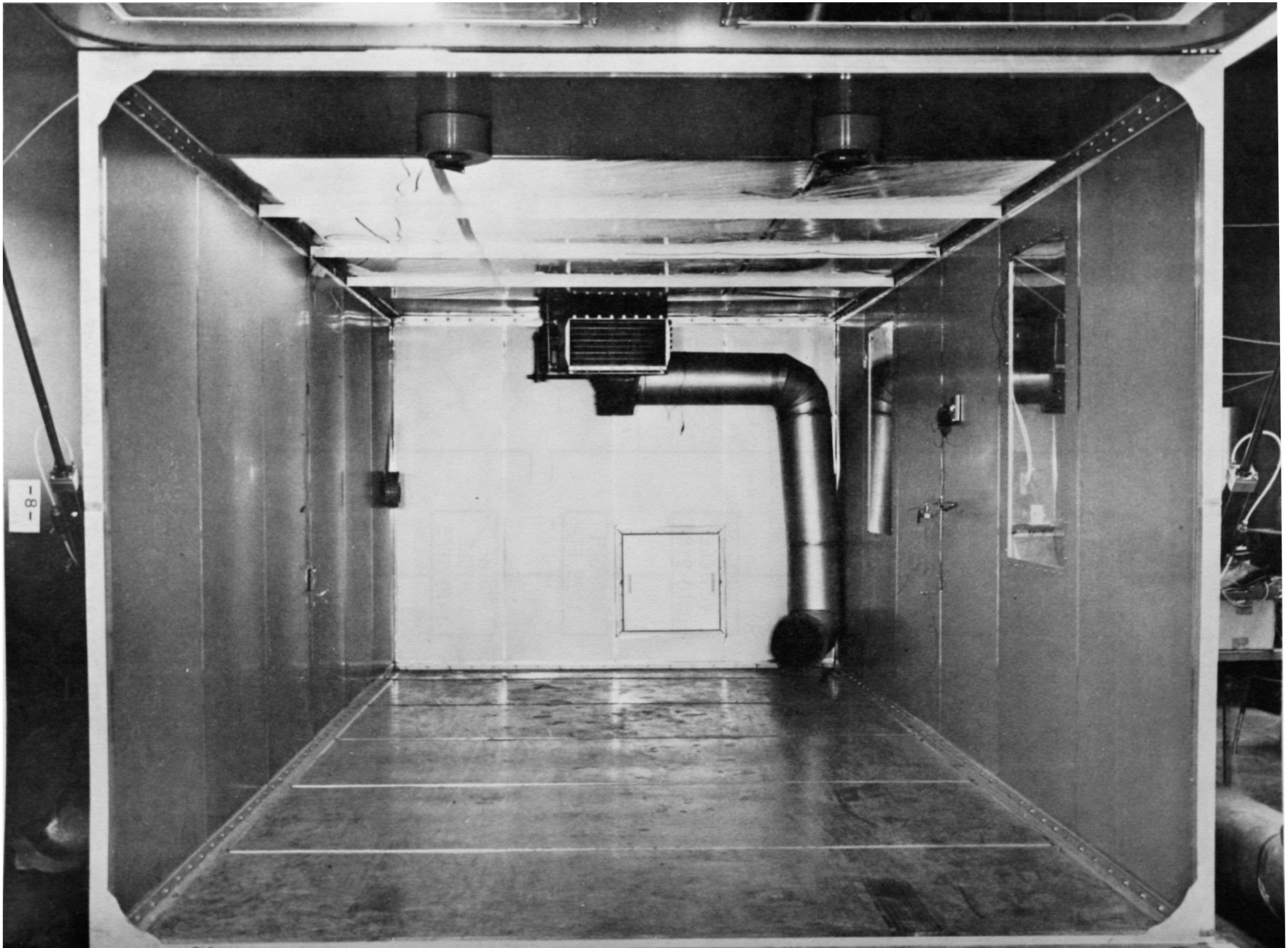


Figure 3-3. INTERIOR OF SHED SHOWING RECIRCULATING FAN AND HEAT EXCHANGER

Figure 3-4. SHED WITH VEHICLE INSIDE AFTER HOT SOAK TEST

Figure 3-5. INSTRUMENT SYSTEM AND CALIBRATION GASES FOR MEASURING HYDROCARBON CONCENTRATION

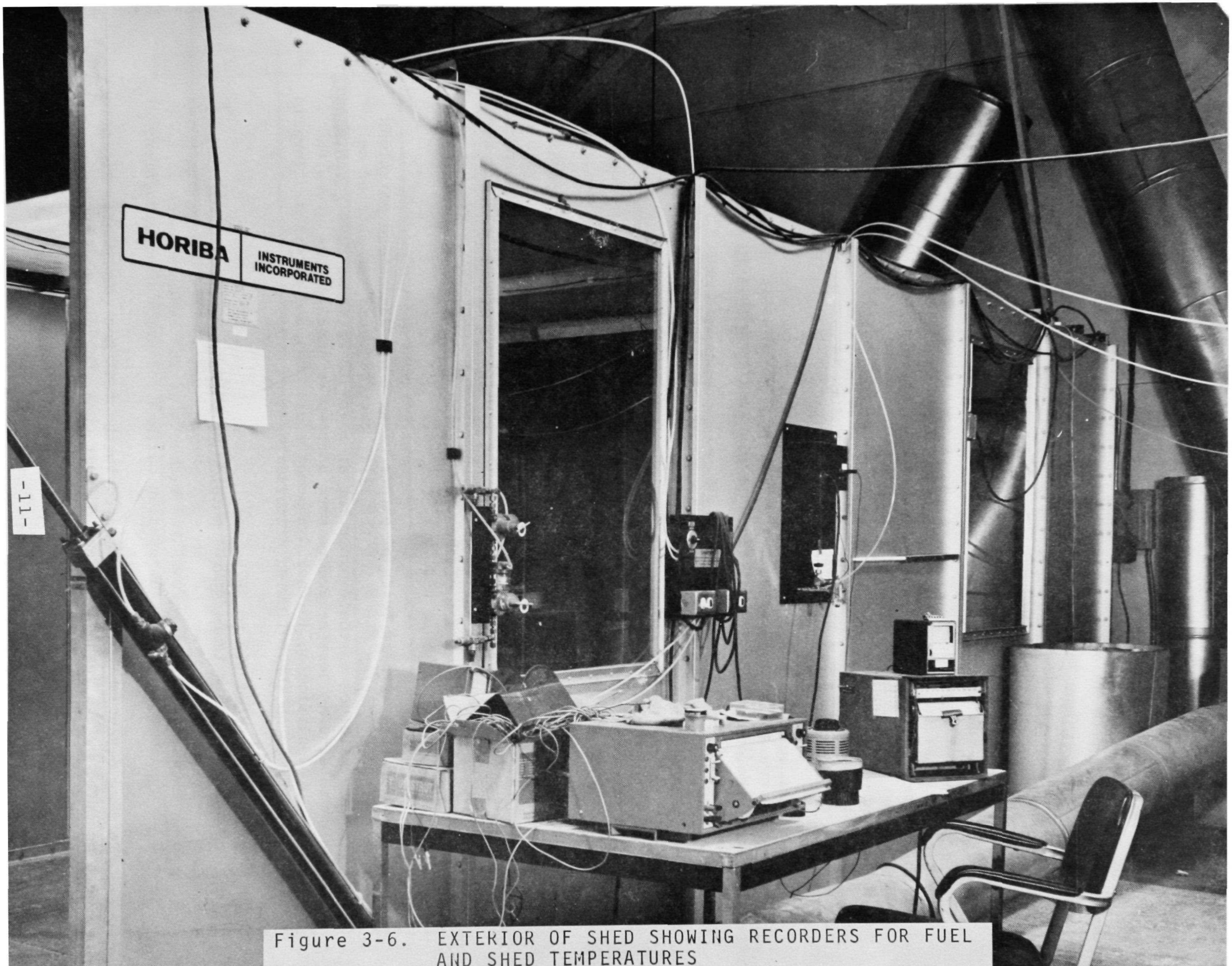


Figure 3-6. EXTERIOR OF SHED SHOWING RECORDERS FOR FUEL AND SHED TEMPERATURES

canister. The fuel system was deemed to be leak tight if the pressure loss in 5 minutes was less than 2 inches of water. Initially, fuel cap pressure checks were made prior to only the first test. After one vehicle (#3006) had been tested, the fuel pressure was checked prior to each test to ensure that no leaks developed during the testing due to repeated removal of the cap as occurred with vehicle #3006.

The tank fuel was drained and replaced with the chilled (53°F-58°F) Indolene Clear test fuel immediately prior to entering the SHED for the diurnal test. The test fuel was analyzed to establish conformity to 40 CFR 86.133-78 specifications and stored under refrigeration until transfer to the vehicle. Table 3-2 summarizes the test fuel RVP and distillation by drum number. The initial batch of fuel (ten drums) was found to be consistently higher in RVP than the batch analysis indicated. It was not possible to firmly establish whether the initial batch was actually high or whether the analytical laboratory (Union Research) had erroneously analyzed these fuel samples.

3.2.3 FTP Exhaust Emission Tests

Exhaust emission tests were performed in accordance with 40 CFR 86.135-78 through 40 CFR 86.137-78, and 40 CFR 86.140-78. The FTP was performed within 1 hour of the end of the diurnal test and was usually initiated within 30 minutes of the end of the diurnal test.

3.2.4 Quality Assurance Procedures

All evaporative and exhaust emission data were audited for compliance with EPA procedures and specifications published in 40 CFR Part 86, Subpart B, and in Sections IV through X of Exhibit C of Contract No. 68-03-2412.

Fuel was stored and transferred in accordance with procedures specified in Section XI of Exhibit C of Contract No. 68-03-2412. A single analysis of each drum was made prior to its use. Each drum was considered within specification if the vendor's batch analysis, and the contractor's drum analysis agreed with the tolerances listed in Table 3-3. The Task Officer approved testing even though the initial batch of fuel was outside the indicated specifications as shown previously in Table 3-2.

Vehicles with invalid tests of either exhaust or evaporative emissions were retested. Vehicles for which the first test sequence was aborted or invalid were returned to their owner for at least 10 calendar days. Vehicles for which subsequent test sequences were aborted or invalid were given the specified preconditioning (either dynamometer or road) and retested. Invalid tests were based on the following criteria:

- o Soak period (12 to 36 hours).
- o Soak or test temperatures outside of 68°F to 86°F.
- o Driver error.
- o Excessive delays between key elements of the test sequence.
- o Dynamometer or instrumentation calibration error or malfunction.

In some cases, which are documented in the test log, procedural violations were accepted by the Task or Project Officer when they did not introduce significant error.

Table 3-2. FUEL ANALYSIS SUMMARY

ANALYSIS	RVP	1BP	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	EBP
Batch	9.0	89	-	127	-	-	-	217	-	-	-	307	403
AO	6.6*	96	136	154	180	200	213	224	232	246	269	316	386
A1	9.2	90	118	134	164	190	210	222	232	245	268	319	394
A2	9.5	86	112	130	160	186	206	218	228	240	264	312	389
A3	9.5	85	110	126	156	185	206	219	228	241	264	313	392
A4	9.5	85	112	128	159	187	206	218	226	240	263	320	390
A5	9.3	85	117	134	164	191	208	221	232	243	266	314	392
A6	9.3	89	119	136	164	190	209	221	231	244	268	316	391
A7	9.4	85	117	134	162	190	208	221	232	244	267	316	388
A8	9.4	86	117	134	162	190	208	221	231	245	266	317	386
A9	9.3	88	120	136	164	191	209	221	233	244	267	316	390
A10	8.9	86	117	137	175	202	216	227	236	248	274	338	390
A11	9.1	92	126	143	175	302	216	227	236	248	272	321	396
A12	8.9	87	117	135	170	199	214	224	234	244	271	325	396
A13	9.0	93	122	139	174	200	216	226	235	247	271	329	393
A14	9.0	91	123	138	173	202	216	226	236	248	272	331	391
A15	9.0	90	123	140	175	201	215	225	235	247	270	328	376
A16	9.2	87	127	127	166	195	211	221	225	249	268	328	391

*Laboratory erroneously analyzed this sample, attempted to repeat the analysis but ran out of sample.

Table 3-3. FUEL TOLERANCES

PROPERTY	EPA SPECIFICATION	ASTM REPRODUCIBILITY	ACCEPTANCE RANGE*
Reid Vapor Pressure (psi)	8.7-9.2	0.3	8.4-9.5
Distillation			
IBP °F	75-95	9	66-104
10% °F	120-135	8	112-143
50% °F	200-230	6	194-236
90% °F	300-325	11	289-336
EBP °F	<415	9	<424

*A fuel will be considered acceptable if the Olson analysis of the drum sample is within the EPA specification or does not differ from an acceptable AMOCO analysis by more than the reproducibility of the analytical method.

In addition, some tests which otherwise complied with routine quality audit procedures were rejected by the Program Manager if the results appeared unreasonable. This occurred on two vehicles in which fuel losses appeared to be excessive even though the fuel system was found to be pressure tight.

Regular daily, weekly, and monthly calibrations and calibration checks were performed in accordance with the contract requirements. Daily start-ups included propane recovery tests; analyzer span, zero, and tune recordings or adjustments; and NO_x converter efficiency checks on the 100 ppm and 1,000 ppm ranges. Weekly calibrations included the daily start-ups plus checks of all analyzer calibration curves using ±1 percent precision gas standards. Any point out of specification (±5 percent of point or ±1 percent of full-scale, whichever was less) required generating new calibration curves. The dynamometer coastdown times were checked every 2 weeks. Monthly calibration checks included dynamometer coastdowns, analyzer curves, and a leak check of the SHED.

In addition to tests performed at Olson, three tests on vehicle #3021 were performed at the California Air Resources Board laboratory in El Monte, California. The preconditioning used by the ARB was slightly different than specified in the Task Order. In spite of these differences, good correlation was obtained between the ARB and Olson test results. Table 3-4 summarizes the results of the correlation tests.

3.3 FAILURE ANALYSIS

The Task Order included a failure analysis (Part B) of evaporative emission control systems with emissions which were judged to be excessive. Vehicles were immediately selected for the failure analysis if their diurnal evaporative emissions exceeded 4 grams per test or hot soak emissions exceeded 6 grams per test on the third test sequence. Two other vehicles were also selected and recalled for subsequent failure analysis when the evaporative emissions appeared to deviate significantly from vehicles with similar emission control systems.

The failure analysis consisted of detection and diagnosis of failed or defective components followed by corrective repair, if warranted. Two vehicles on which corrective repairs were performed were subjected to a final Evaporative/Exhaust Emission Test sequence described in Section 3.2. However, no vehicles were actually detected with defective evaporative emission control systems.

Vehicles with high emissions were subjected to a "sniffer" test using a flame ionization detector (FID) in conjunction with a visual inspection to identify the source of the excess emissions. A visual examination of components was made to determine the reasons for failure. The "sniffer" test consisted of measuring hydrocarbon concentrations near suspected sources of evaporative emissions before, immediately after, and 15 minutes after an LA-4 driving schedule. The suspected sources included the following: fuel cap, carbon canister, air cleaner snorkel, and base of carburetor.

3.4 DATA ANALYSIS

Data analysis for Task Order 3 included recording, reduction, and interpretation of test results and descriptive information.

Table 3-4. EVAPORATIVE EMISSION CORRELATION DATA (GM/TEST)

OLSON RESULTS			
PRECONDITIONING	DIURNAL	HOT SOAK	TOTAL
40 Mile Freeway	3.9	12.1	16.0
1975 FTP	3.9	11.7	15.6
10-Minute Road	4.2	12.7	16.9
ARB RESULTS			
PRECONDITIONING	DIURNAL	HOT SOAK	TOTAL
40 Mile Freeway*	9.0	13.2	22.2
40 Mile Road and LA-4	4.9	11.2	16.1
LA-4 (1972 FTP)	3.8	12.4	16.2
40 Mile Road and LA-4	3.9	13.2	17.1

*Vehicle was tested without preconditioning several days after being delivered to the ARB laboratory.

3.4.1 Data Recording and Reduction

Test data were recorded on standard data forms used during the 1975 FY Emission Factor Test Program. However, some modifications to the forms were required for this Task Order to accommodate specific additional information. In addition, data regarding idle parameter specifications and measurements were not reported.

The test data were reduced by converting deflections and ranges to concentrations, and auditing the data. This function was performed by Olson's Data Quality Assurance group. Punched card output in the format defined by EPA was provided to the Project Officer at the end of this task.

3.4.2 Data Analysis and Interpretation

The interpretation of the data included establishing the relationship between preconditioning and emission levels. Tests for statistically significant differences were performed between the second emission test, which was considered the baseline test, and the other tests to determine whether preconditioning caused statistically different emissions.

The statistical test used to determine significant differences in emissions due to preconditioning was the paired t-test. This test applies to cases where two treatments; i.e., preconditioning, are applied to each member of a population. In this case, each member was one of the vehicles in the test fleet. The paired t-test was evaluated at the 95 percent confidence level and was applied to the following comparisons of preconditioning.

- o None versus 1974 FTP
- o None versus road route
- o 1975 FTP versus road route

In addition to statistical tests, diurnal evaporative emission data were plotted as a function of the amount of fuel in the tank, ambient air temperature, and distance driven prior to the first evaporative emissions test. These plots were prepared for both the actual diurnal emission level and diurnal data normalized by dividing the first test (no preconditioning) by the second test (1975 FTP).

Section 4

RESULTS

4.1 EFFECT OF PRECONDITIONING ON EVAPORATIVE AND EXHAUST EMISSIONS

Table 4-1 presents composite evaporative and exhaust emission data for each vehicle. Summaries showing the average, minimum, and maximum value of the evaporative emissions are shown in Table 4-2. Based on these results, it can be seen that no preconditioning resulted in higher diurnal evaporative emissions than either dynamometer or road preconditioning. These results were significant at the 95 percent confidence level for the 1977 model-year vehicles and for all vehicles excluding Fords. Dynamometer preconditioning did not result in significantly different evaporative emissions at 95 percent or higher confidence levels than did road preconditioning.

Table 4-3 summarizes cold transient and composite FTP exhaust emissions in grams per mile. Exhaust emissions were not significantly affected by the type of preconditioning at 95 percent confidence levels although no preconditioning resulted in slightly higher HC (Bag 1) and CO (Composite) emissions than either road or dynamometer preconditioning.

Diurnal evaporative emission data were plotted in Figures 4-1 through 4-3 for the actual diurnal emissions in grams per test and in Figures 4-4 through 4-6 for the ratio of first test divided by second test. No clear trends were determined between any of the as-received vehicle characteristics (fuel-level, ambient air temperature, and distance driven to the laboratory). Four vehicles, however, were clearly higher than the other 16 in all cases. These vehicles were not the Ford vehicles.

4.2 ANALYSIS OF FAILED EVAPORATIVE EMISSION CONTROL SYSTEMS

Three vehicles had evaporative emissions which were significantly higher than the other 17 vehicles. All three of these vehicles had evaporative emissions between 15 to 20 grams per test. All of these vehicles were 1976 Fords; two were 250-CID Mavericks, and one was a 302-CID Granada. All three vehicles had similar Carter carburetors without float chamber emission control. The emission tests indicated high hot soak emissions. The Granada and both Mavericks were subjected to a "sniffer" test to evaluate the source of emissions. Both vehicles showed very high levels at the base of the carburetor shortly after completing the LA-4 driving cycle. These data are presented in the Appendix. One vehicle (the Granada with 302-CID engine) was selected for further testing. Figure 4-7 shows the engine compartment and the location of the area with high evaporative emissions. The air cleaner was removed (Figure 4-8) revealing the passage in the carburetor casting for the choke linkage. This passage allowed fuel vapors from the float chamber equalizer vent tube to escape from the air cleaner housing. The relatively low emissions during the diurnal heat build suggested that the carbon canister was performing

Table 4-1. COMPOSITE EVAPORATIVE AND EXHAUST EMISSIONS

EVAP CUM REPORT CALIFORNIA

VEHICLE NUMBER	MODEL YEAR	MAKE	CID	TEST TYPE	---- EMISSION RESULTS (GMS/MI) ---- HC	CO	CO2	NOXC	FUEL ECON (MPG)	TEST NO.
3001	1977	DODG	225	1975 FTP	0.26	2.69	575.8	1.55	15.28	1
				1975 FTP	0.28	1.41	586.8	1.61	15.05	2
				1975 FTP	0.29	3.08	567.7	1.58	15.48	3
				EVAP TST	6.98 GRAMS OF HC		....			1
				EVAP TST	5.76 GRAMS OF HC		....			2
				EVAP TST	4.97 GRAMS OF HC		....			3
3002	1977	PLYM	225	1975 FTP	0.30	3.69	521.0	0.87	16.82	1
				1975 FTP	0.23	3.30	537.0	1.41	16.35	2
				1975 FTP	0.38	3.69	534.3	1.22	16.40	3
				EVAP TST	3.35 GRAMS OF HC		....			1
				EVAP TST	2.10 GRAMS OF HC		....			2
				EVAP TST	3.60 GRAMS OF HC		....			3
3003	1977	DODG	360	1975 FTP	0.84	26.16	794.1	1.63	10.59	1
				1975 FTP	0.68	23.05	792.4	1.62	10.68	2
				1975 FTP	0.84	26.14	788.6	1.76	10.66	3
				EVAP TST	2.42 GRAMS OF HC		....			1
				EVAP TST	2.18 GRAMS OF HC		....			2
				EVAP TST	2.52 GRAMS OF HC		....			3
3004	1977	CHRY	360	1975 FTP	0.83	14.64	726.0	1.58	11.81	1
				1975 FTP	0.45	5.60	724.7	1.72	12.08	2
				1975 FTP	0.79	15.37	728.4	1.69	11.75	3
				1975 FTP	0.68	10.59	736.5	1.68	11.75	4
				EVAP TST	8.33 GRAMS OF HC		....			1
				EVAP TST	5.77 GRAMS OF HC		....			2
				EVAP TST	4.62 GRAMS OF HC		....			3
				EVAP TST	3.37 GRAMS OF HC		....			4
3005	1977	CHRY	360	1975 FTP	1.82	59.31	688.5	1.35	11.27	1
				1975 FTP	1.52	55.05	703.9	1.24	11.16	2
				1975 FTP	1.76	62.93	689.0	1.28	11.19	3
				EVAP TST	5.00 GRAMS OF HC		....			1
				EVAP TST	3.58 GRAMS OF HC		....			2
				EVAP TST	3.95 GRAMS OF HC		....			3
3006	1977	DODG	360	1975 FTP	0.37	9.86	799.0	0.80	10.88	1
				1975 FTP	0.40	7.85	801.1	0.83	10.89	2
				1975 FTP	0.42	5.79	793.7	0.82	11.04	3
				EVAP TST	2.79 GRAMS OF HC		....			1
				EVAP TST	2.51 GRAMS OF HC		....			2
				EVAP TST	2.67 GRAMS OF HC		....			3
3007	1977	CHEV	140	1975 FTP	0.66	22.62	480.1	1.39	17.14	1
				1975 FTP	0.60	19.89	483.5	1.34	17.18	2
				1975 FTP	0.69	21.96	459.4	1.18	17.89	3
				EVAP TST	15.85 GRAMS OF HC		....			1
				EVAP TST	3.34 GRAMS OF HC		....			2

Table 4-1. COMPOSITE EVAPORATIVE AND EXHAUST EMISSIONS (Continued)

EVAP CUM REPORT CALIFORNIA

VEHICLE NUMBER	MODEL YEAR	MAKE	CID	TEST TYPE	---- EMISSION RESULTS (GMS/MI) ---- HC	CO	CO2	NOXC	FUEL ECON (MPG)	TEST NO.
				EVAP TST	5.99	GRAMS OF HC	....			3
3008	1977	CHEV	140	1975 FTP	0.68	15.32	356.5	4.09	23.19	1
				1975 FTP	0.65	13.54	365.3	4.23	22.84	2
				1975 FTP	0.53	11.14	357.5	4.09	23.56	3
				EVAP TST	4.20	GRAMS OF HC	....			1
				EVAP TST	1.29	GRAMS OF HC	....			2
				EVAP TST	1.59	GRAMS OF HC	....			3
3009	1977	PONT	151	1975 FTP	0.37	5.59	478.4	1.17	18.17	1
				1975 FTP	0.33	4.87	490.0	1.29	17.80	2
				1975 FTP	0.34	4.87	480.3	1.25	18.15	3
				EVAP TST	2.86	GRAMS OF HC	....			1
				EVAP TST	5.31	GRAMS OF HC	....			2
				EVAP TST	5.20	GRAMS OF HC	....			3
3010	1977	PONT	151	1975 FTP	0.37	12.04	494.5	1.16	17.25	1
				1975 FTP	0.33	10.75	489.7	1.07	17.48	2
				1975 FTP	0.31	10.76	492.8	1.11	17.38	3
				1975 FTP	0.29	10.86	500.4	1.09	17.12	4
				EVAP TST	9.21	GRAMS OF HC	....			1
				EVAP TST	7.12	GRAMS OF HC	....			2
				EVAP TST	1.80	GRAMS OF HC	....			3
				EVAP TST	6.98	GRAMS OF HC	....			4
3011	1977	DATS	168	1975 FTP	1.70	75.72	459.2	0.31	15.21	1
				1975 FTP	1.76	75.24	456.2	0.31	15.30	2
				1975 FTP	1.93	87.60	473.5	0.33	14.38	3
				EVAP TST	4.15	GRAMS OF HC	....			1
				EVAP TST	1.59	GRAMS OF HC	....			2
				EVAP TST	1.60	GRAMS OF HC	....			3
3013	1977	BUIC	231	1975 FTP	0.38	3.95	612.6	1.05	14.31	1
				1975 FTP	0.39	4.17	637.7	1.14	13.75	2
				1975 FTP	0.46	3.61	603.9	1.06	14.53	3
				EVAP TST	6.16	GRAMS OF HC	....			1
				EVAP TST	4.94	GRAMS OF HC	....			2
				EVAP TST	5.56	GRAMS OF HC	....			3
3014	1976	FORD	250	1975 FTP	0.38	1.69	525.7	1.12	16.76	1
				1975 FTP	0.39	1.63	534.2	1.12	16.50	2
				1975 FTP	0.43	1.81	527.4	1.08	16.69	3
				EVAP TST	24.80	GRAMS OF HC	....			1
				EVAP TST	16.59	GRAMS OF HC	....			2
				EVAP TST	20.57	GRAMS OF HC	....			3
3015	1976	FORD	250	1975 FTP	0.39	1.44	593.5	1.75	14.87	1
				1975 FTP	0.37	1.68	630.0	1.54	14.00	2
				1975 FTP	0.75	3.76	723.0	2.10	12.14	3
				EVAP TST	15.20	GRAMS OF HC	....			1

Table 4-1. COMPOSITE EVAPORATIVE AND EXHAUST EMISSIONS (Continued)

EVAP CUM REPORT CALIFORNIA

VEHICLE NUMBER	MODEL YEAR	MAKE	CID	TEST TYPE	---- EMISSION RESULTS (GMS/MI) ---- HC	CO	CO2	NOXC	FUEL ECON (MPG)	TEST NO.
				EVAP TST	17.69	GRAMS OF HC	....			2
				EVAP TST	20.28	GRAMS OF HC	....			3
3016	1976	CHEV	140	1975 FTP	0.27	5.96	426.5	4.55	20.32	1
				1975 FTP	0.25	5.81	417.8	4.57	20.75	2
				1975 FTP	0.23	4.15	416.9	4.47	20.93	3
				EVAP TST	1.48	GRAMS OF HC	....			1
				EVAP TST	1.45	GRAMS OF HC	....			2
				EVAP TST	1.57	GRAMS OF HC	....			3
3017	1976	CHEV	140	1975 FTP	0.53	7.00	461.1	1.47	18.73	1
				1975 FTP	0.62	6.86	497.6	1.66	17.39	2
				1975 FTP	0.41	6.02	503.5	1.69	17.26	3
				EVAP TST	1.17	GRAMS OF HC	....			1
				EVAP TST	1.57	GRAMS OF HC	....			2
				EVAP TST	1.60	GRAMS OF HC	....			3
3018	1975	OLDS	350	1975 FTP	1.12	19.32	611.1	3.60	13.76	1
				1975 FTP	1.16	36.35	621.5	3.75	13.01	2
				1975 FTP	0.97	12.33	685.9	4.54	12.53	3
				EVAP TST	2.38	GRAMS OF HC	....			1
				EVAP TST	2.05	GRAMS OF HC	....			2
				EVAP TST	5.50	GRAMS OF HC	....			3
3019	1975	OLDS	350	1975 FTP	0.37	3.47	722.7	1.34	12.17	1
				1975 FTP	0.45	3.03	724.3	1.21	12.15	2
				1975 FTP	0.43	3.46	726.2	1.23	12.11	3
				EVAP TST	1.54	GRAMS OF HC	....			1
				EVAP TST	2.05	GRAMS OF HC	....			2
				EVAP TST	2.21	GRAMS OF HC	....			3
3020	1976	VOLK	97	1975 FTP	0.77	12.69	359.4	1.14	23.25	1
				1975 FTP	0.77	12.44	360.9	1.21	23.18	2
				1975 FTP	0.71	10.68	361.2	1.44	23.34	3
				EVAP TST	3.68	GRAMS OF HC	....			1
				EVAP TST	3.96	GRAMS OF HC	....			2
				EVAP TST	3.32	GRAMS OF HC	....			3
3021	1976	FORD	302	1975 FTP	1.34	6.42	613.0	1.52	14.15	1
				1975 FTP	1.27	7.52	624.2	1.50	13.87	2
				1975 FTP	1.24	8.65	609.8	1.42	14.15	3
				EVAP TST	15.96	GRAMS OF HC	....			1
				EVAP TST	15.56	GRAMS OF HC	....			2
				EVAP TST	16.83	GRAMS OF HC	....			3

Table 4-2. EFFECT OF PRECONDITIONING ON EVAPORATIVE EMISSIONS

DESCRIPTION	TYPE OF PRECONDITIONING								
	NONE			DYNO-1975 FTP			ROAD-10 MINUTE ROUTE		
	Diurnal	Hot Soak	Comp.	Diurnal	Hot Soak	Comp.	Diurnal	Hot Soak	Comp.
All Vehicles									
Number	20	20	20	20	20	20	20	20	20
Average	3.07	3.80	6.88	1.92	3.41	5.33	1.99	3.81	5.80
Minimum	0.29	0.90	1.17	0.35	0.63	1.29	0.34	0.84	1.52
Maximum	12.91	14.85	24.81	5.57	15.43	17.69	7.27	19.11	20.59
1977 MY									
Number	12	12	12	12	12	12	12	12	12
Average	3.37	2.58	5.95	1.92	1.87	3.80	1.68	2.00	3.68
Minimum	0.95	1.29	2.42	0.40	0.89	1.29	0.51	4.54	1.59
Maximum	12.56	5.83	15.86	5.57	4.79	7.13	3.72	0.93	5.99
Excluding Fords									
Number	17	17	17	17	17	17	17	17	17
Average	2.60	2.19	4.80	1.66	1.68	3.34	1.60	1.84	3.42
Minimum	0.29	0.70	1.17	0.35	0.63	1.29	0.34	0.84	1.57
Maximum	12.56	4.54	15.86	5.57	4.79	7.13	3.72	4.54	5.99

Table 4-3. EFFECT OF PRECONDITIONING ON EXHAUST EMISSIONS OF 20 VEHICLES

	PRECONDITIONING								
	NONE			DYNO-1975 FTP			ROAD-10-MIN. ROUTE		
	HC	CO	NO_x C	HC	CO	NO_x C	HC	CO	NO_x C
Bag 1 GM/Mile									
Average	1.66	36.38	2.25	1.55	37.18	2.27	1.56	36.71	2.33
Minimum	0.48	6.45	0.38	0.52	4.66	0.37	0.50	7.99	0.44
Maximum	3.30	110.98	5.18	3.28	112.95	5.05	3.39	124.24	5.98
Composite GM/Mile									
Average	0.69	16.48	1.67	0.67	15.00	1.72	0.72	15.39	1.77
Minimum	0.26	1.44	0.31	0.23	1.41	0.31	0.23	1.81	0.33
Maximum	1.82	75.72	4.55	1.76	75.24	4.57	1.93	87.60	4.47

Figure 4-1. DIURNAL EMISSIONS VERSUS FUEL LEVEL

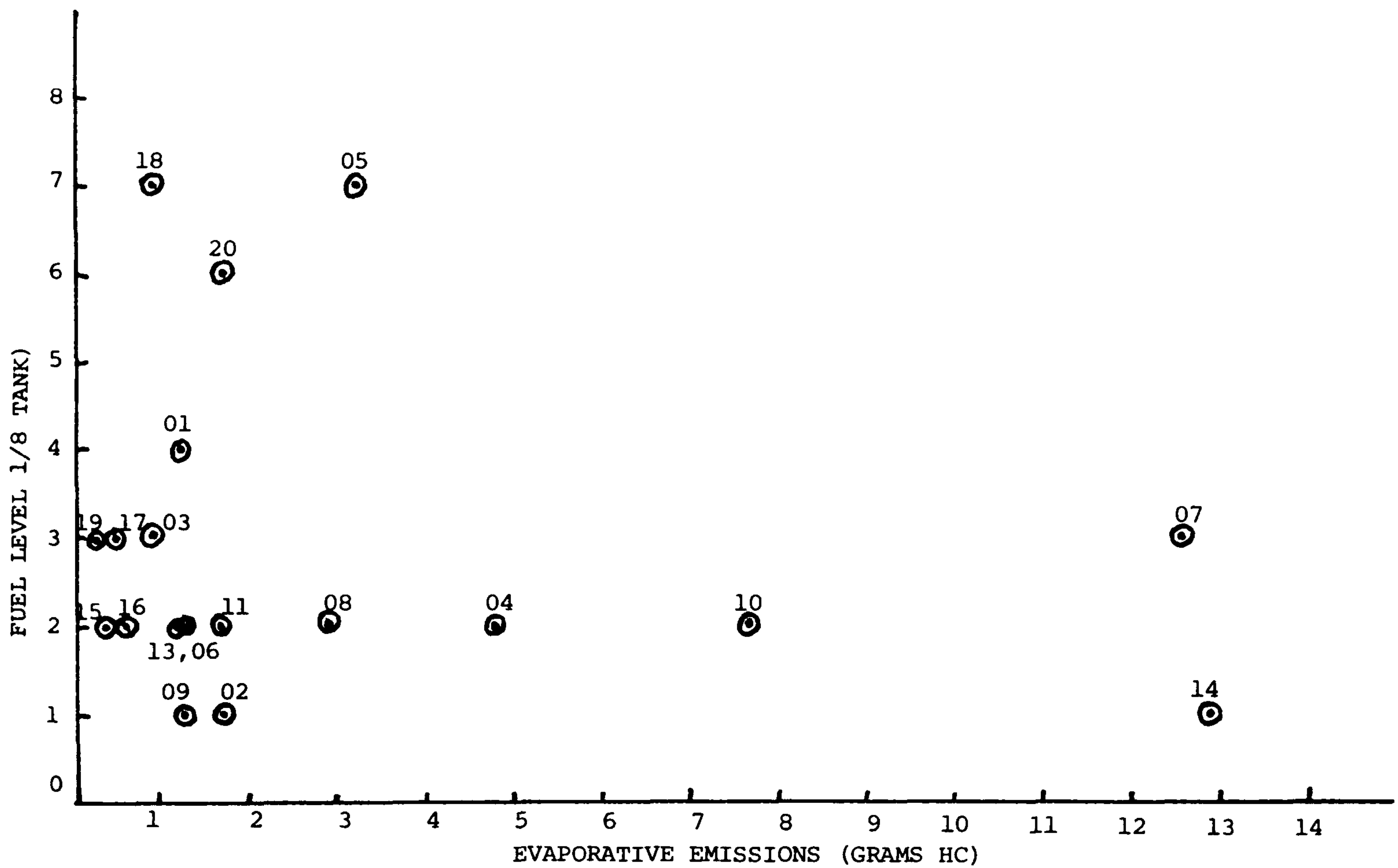


Figure 4-2. DIURNAL EMISSIONS VERSUS AIR TEMPERATURE

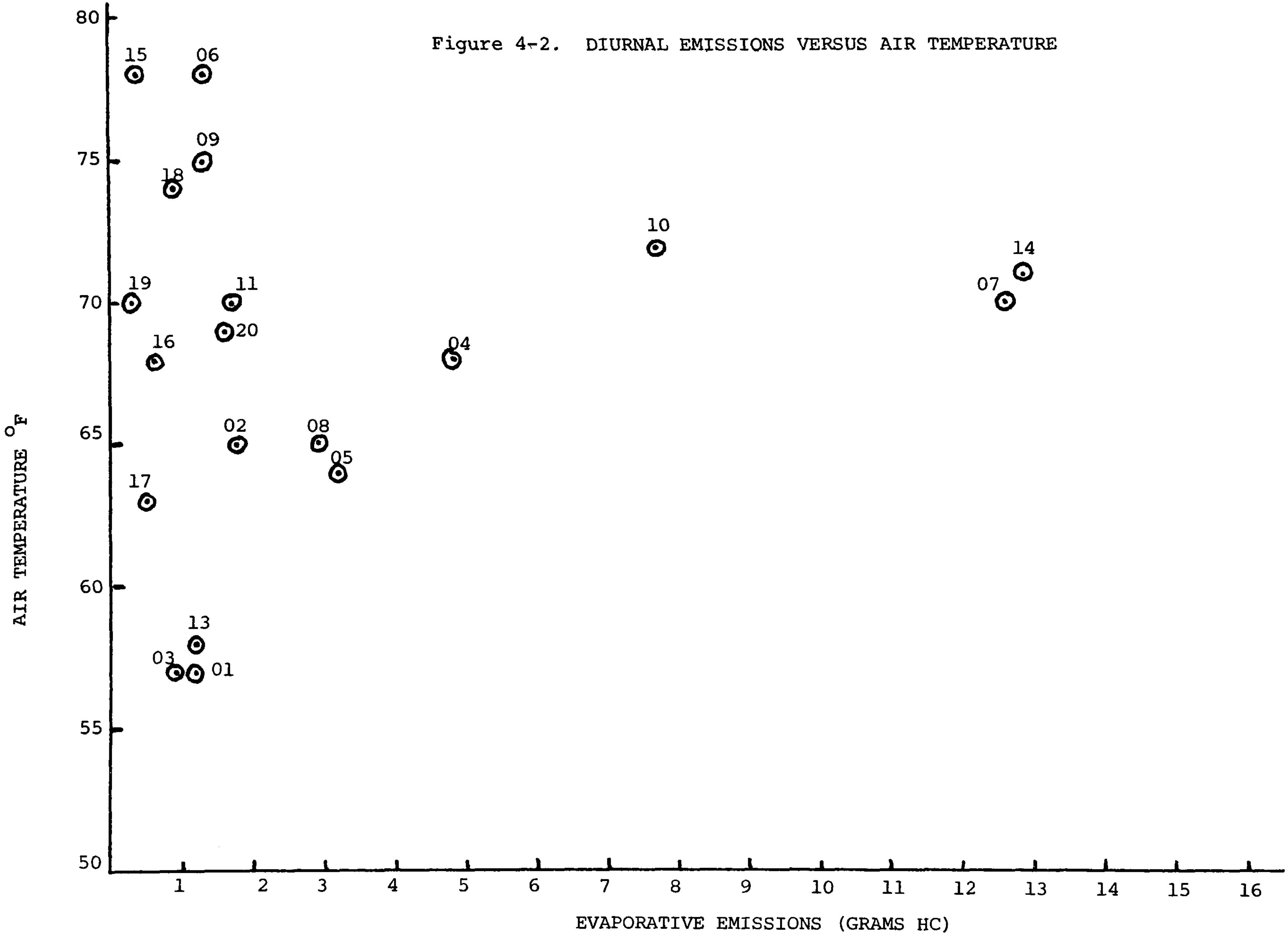


Figure 4-3. DIURNAL EMISSIONS VERSUS MILES DRIVEN

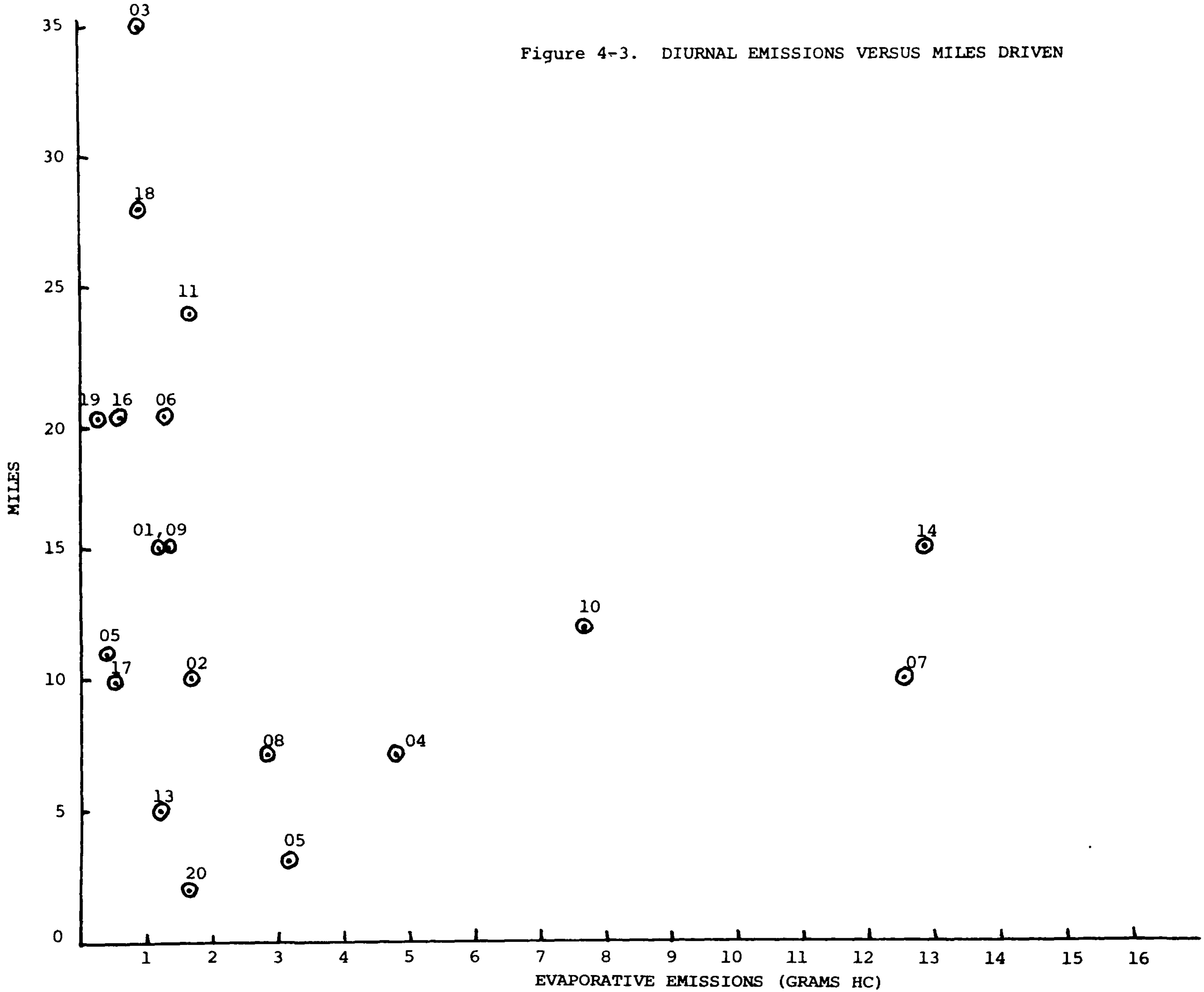
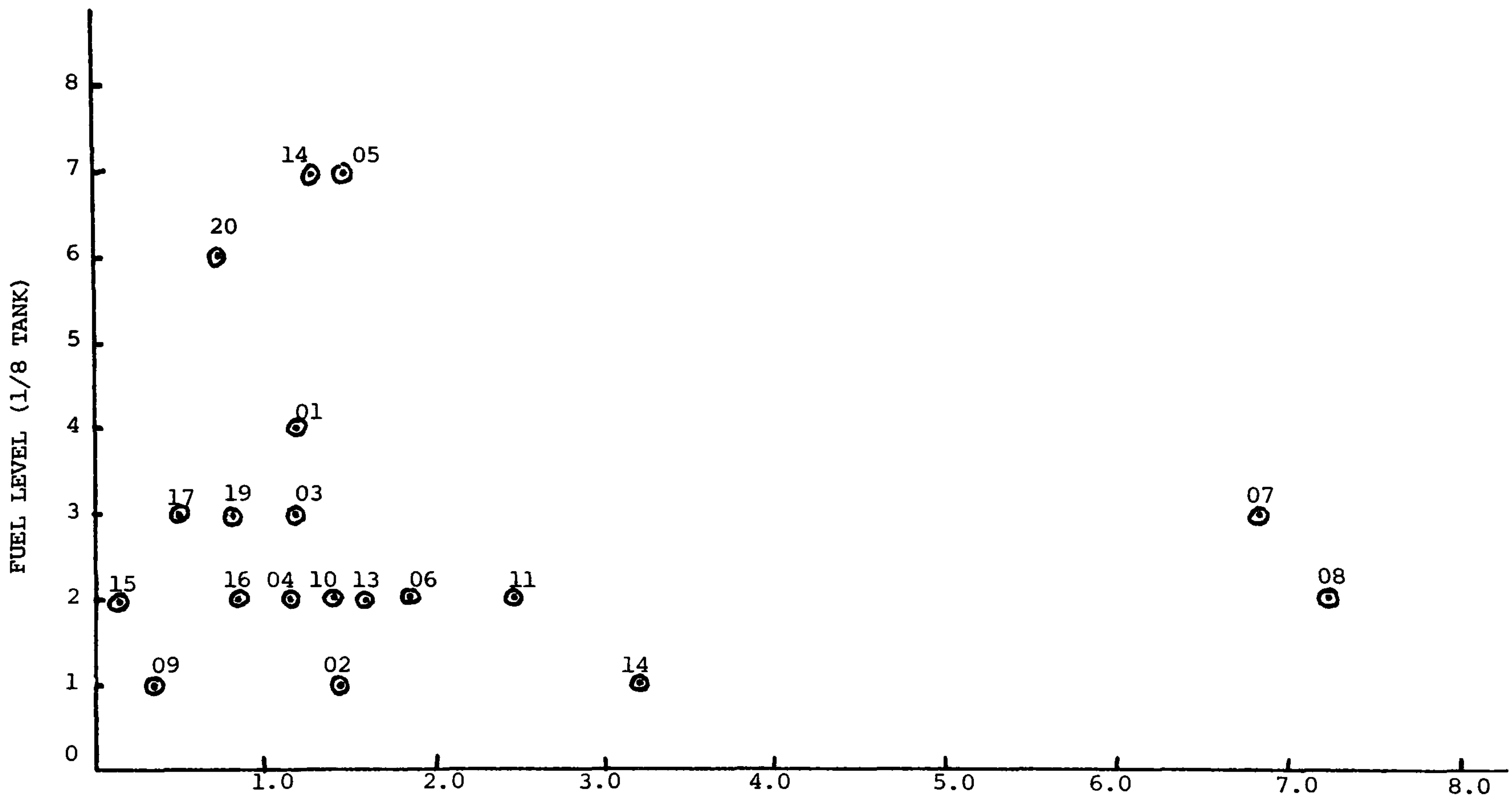


Figure 4-4. NORMALIZED EMISSIONS VERSUS FUEL LEVEL



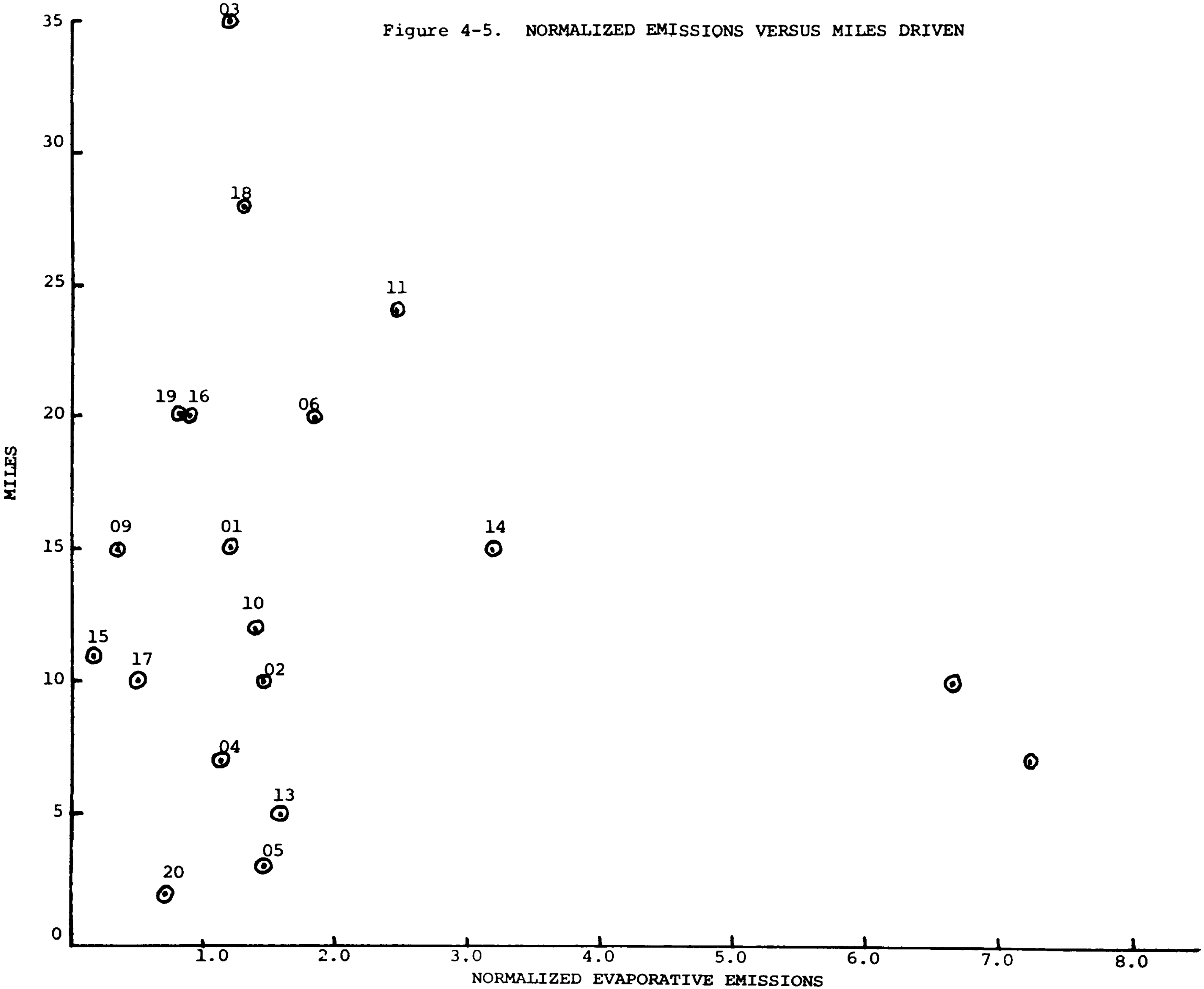


Figure 4-5. NORMALIZED EMISSIONS VERSUS MILES DRIVEN

Figure 4-6. NORMALIZED DIURNAL EMISSIONS VERSUS AIR TEMPERATURE

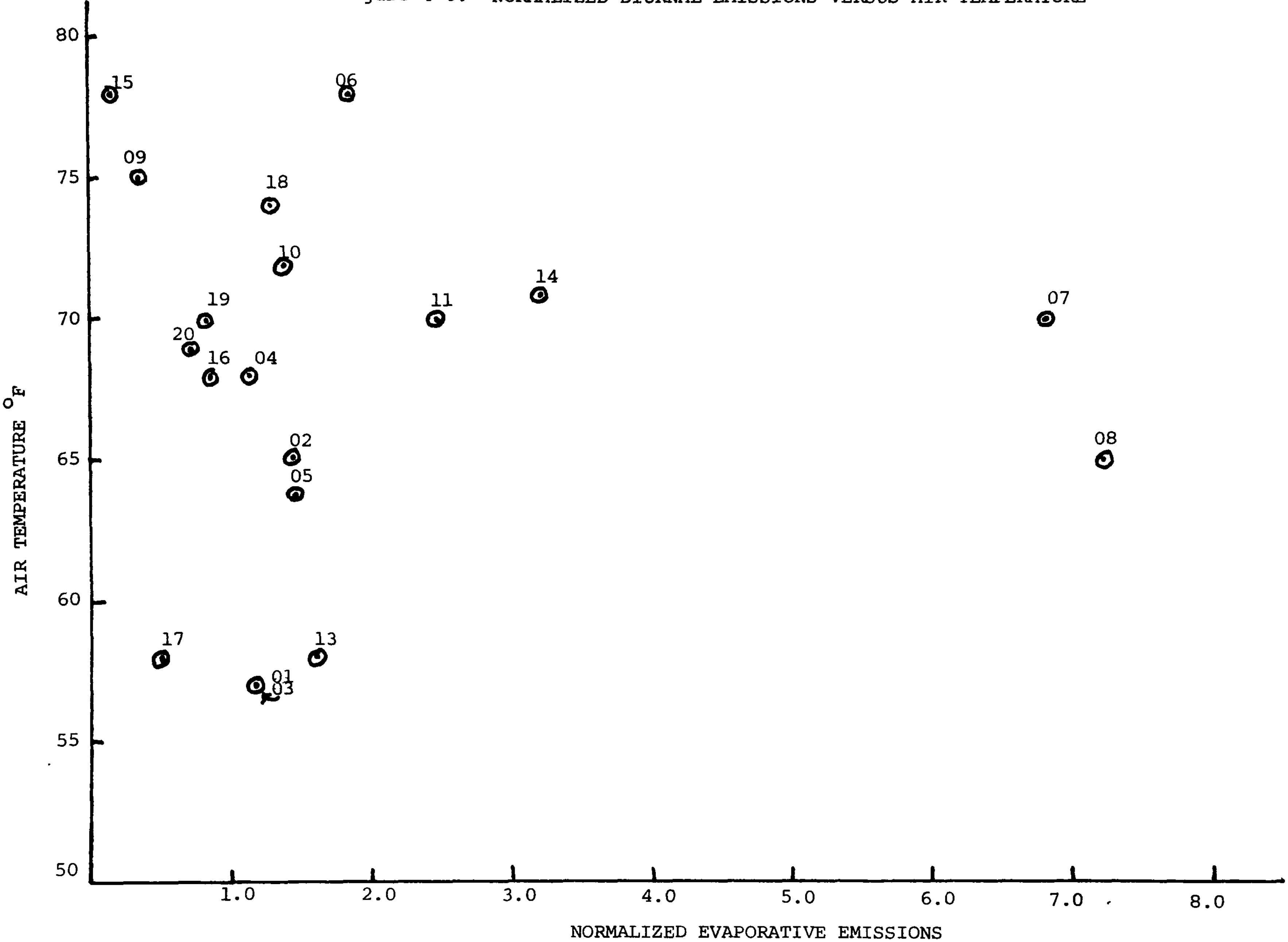


Figure 4-7. ENGINE COMPARTMENT (1976 FORD GRANADA) SHOWING LOCATION OF HOT SOAK EVAPORATIVE EMISSIONS

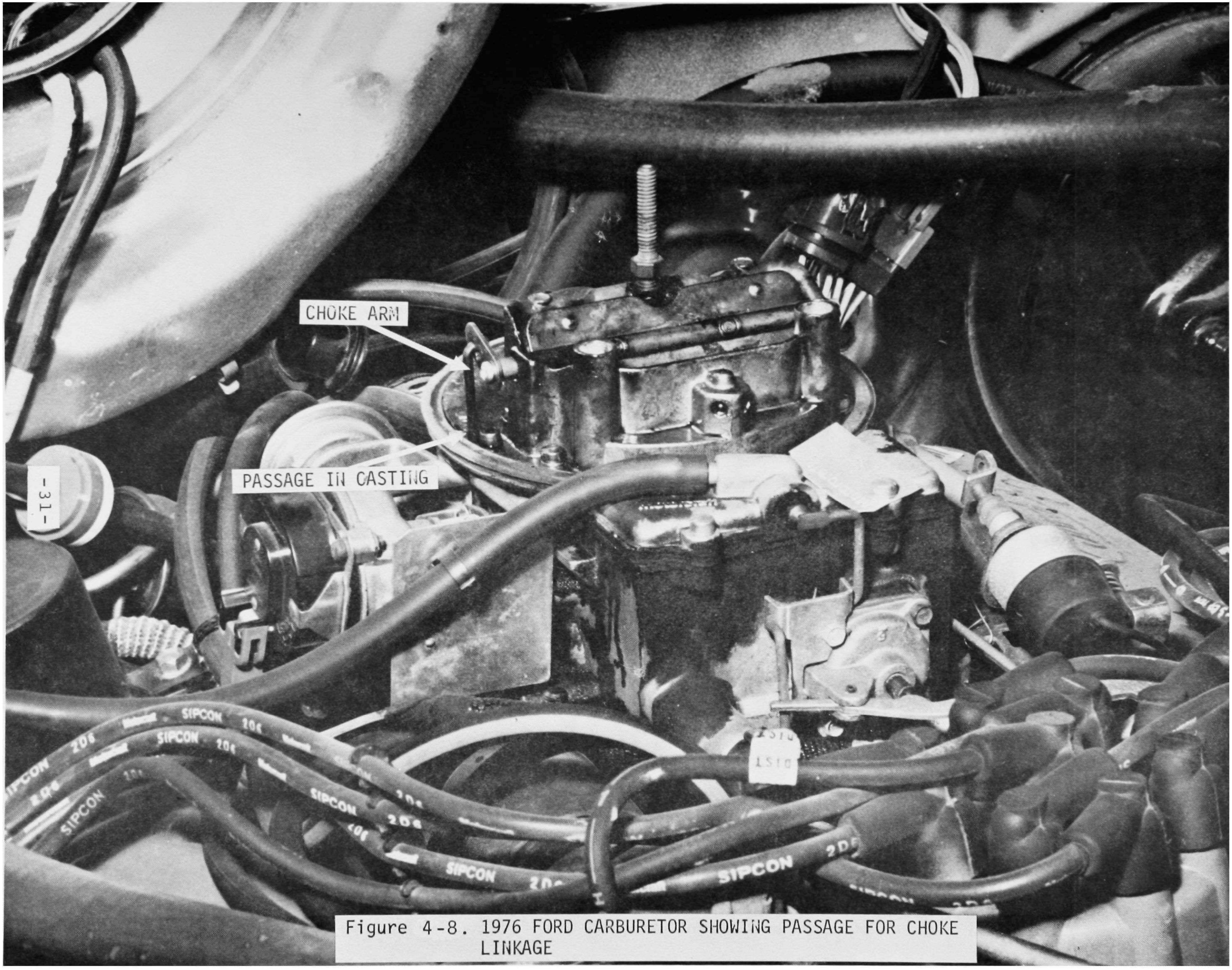


Figure 4-8. 1976 FORD CARBURETOR SHOWING PASSAGE FOR CHOKE LINKAGE

satisfactorily in controlling fuel tank emissions. Since this carburetor was not designed to control carburetor evaporative emissions, there was no corrective maintenance which could be performed, however, to determine whether there were any additional vapor losses passed the gasket which seals the carburetor and the base of the air cleaner canister. The gasket was covered with silicone stopcock grease and a hot soak diurnal test was then performed. There was no differences between the evaporative emissions performed with the sealing gasket as compared to the original gasket (11.15 grams versus 12.6 grams). Since the two Ford Mavericks were also equipped with carburetors of similar design, they were not analyzed further.

Two vehicles (#3004 and #3010) showed relatively high diurnal emissions. Both vehicles were recalled and their carbon canisters were replaced with OEM equivalent units. A final evaporative emission test (Number 4 in the Appendix) was performed on each vehicle following an LA-4 dynamometer preconditioning and cold soak. Vehicle #3004 (Chrysler Cordoba 360 CID) showed reduced diurnal emissions but increased in hot soak emissions. An FID sniffer test was performed on this vehicle since hot soak emissions which would be detected during the sniffer test were shown to be low. As shown in the Appendix, this vehicle's hot soak emissions after the carbon canister replacement were lower than the initial as-received emissions, but were higher than the hot soak emissions after preconditioning. The reason for the high hot soak emissions could not be determined.

The second vehicle (#3010) was a 1977 Pontiac Astre 151 CID. This vehicle's emissions were not affected by installation of the new canister. Both diurnal and hot soak emissions after the canister replacement were similar to the dynamometer preconditioning results obtained on Test 2. The reason for the increase in diurnal emissions could not be determined. However, it is possible that dynamometer preconditioning did not fully purge the carbon canister since the third emission (after road preconditioning) test was very low.

A P P E N D I X

001 CARD LISTING
VEHICLE DESCRIPTION DATA

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3001	77/05/09	10	NL45C7G137289	77	DODG	ASPE	3	225	1	1	6	2	4000	12.0	2	4779
3002	77/04/18	12	HP41C7G102657	77	PLYM	VOLA	3	225	1	1	6	1	3500	12.3	1	10943
3003	77/05/09	10	WL46J7A110126	77	DODG	MONO	1	360	1	4	8	1	4500	14.0	1	17787
3004	77/04/25	09	SS2257R146706	77	CHRY	CORD	2	360	1	4	8	1	4500	14.0	1	4036
3005	77/05/23	09	CL41J7D113953	77	CHRY	NEWP	1	360	1	4	8	1	5000	14.7	1	10255
3006	77/06/01	10	WL46J7A174297	77	DODG	MONO	1	360	1	4	8	1	4500	14.0	1	1707
3007	77/04/25	03	1M27B72106656	77	CHEV	MONZ	4	140	5	2	4	1	3000	11.3	1	7259
3008	77/05/23	03	1V77B7U108266	77	CHEV	VEGA	4	140	4	2	4	2	2750	9.9	2	6107
3009	77/05/17	05	2C77V7U511414	77	PONT	ASTR	4	151	1	2	4	1	3000	11.3	1	3239
3010	77/05/17	05	2C77V7U510549	77	PONT	ASTR	4	151	1	2	4	1	3000	11.3	1	2366
3011	77/04/26	14	HLS30363522	77	DATS	280Z	4	168	1	0	6	1	3000	11.3	1	2146
3013	77/05/09	01	4B69C7L108409	77	BUIC	SKYL	3	231	1	2	6	1	3500	12.3	1	5135
3014	77/04/20	06	F6K91L172869F	76	FORD	MAVE	3	250	1	1	6	2	3000	10.3	2	16083
3015	77/05/17	06	F6K91L154923F	76	FORD	MAVE	3	250	1	1	6	1	3000	11.3	1	11149
3016	77/05/23	03	1V77B6U126154	76	CHEV	VEGA	4	140	1	2	4	1	2750	10.9	1	3760
3017	77/03/21	03	1V15B6U225373	76	CHEV	VEGA	4	140	1	2	4	1	3000	11.3	1	4702
3018	77/05/04	04	3J57K5R157191	75	OLDS	CUTL	2	350	1	4	8	1	4000	13.2	1	35997
3019	77/03/25	04	3K57K5R163417	75	OLDS	CUTL	2	350	1	4	8	1	4000	13.2	1	13521
3020	77/03/07	16	1162160836	76	VOLK	SEDA	4	97	4	0	4	2	2000	8.3	2	4339
3021	77/03/23	06	6W82F296163	76	FORD	GRAN	3	302	1	2	6	1	3500	12.3	1	7321

MOD SIZE 1 = Full, 2 = Intermediate, 3 = Compact, 4 = Subcompact
TR: 1 = Automatic, 4 = 4-Speed Manual, 5 = 5-Speed Manual
CV: 0 = Fuel Injection, 1 = 1 Barrel, 2 = 2 Barrel, 4 = 4 Barrel
AC, A/C SIM: 1 = Air Conditioning, 2 = No Air Conditioning

002 CARD LISTING

EMISSION CONTROL SYSTMS

CAR NO.	FTC	EM	AIR	EGR	FT	CAT	TR	PCV	CBE	FTE	CCC	CC	CCP
3001	190	1	1	1	2	1	2	1	2	1	1	2	2
3002	180	1	1	1	2	1	2	1	2	1	1	2	2
3003	240	1	1	1	2	1	2	1	2	1	1	2	2
3004	255	1	2	1	2	1	2	1	2	1	1	2	2
3005	265	1	1	1	2	1	2	1	2	1	1	2	2
3006	240	1	1	1	2	1	2	1	2	1	1	2	2
3007	185	1	2	1	2	1	2	1	2	1	2	2	2
3008	160	1	2	1	2	1	2	1	2	1	2	2	2
3009	160	1	2	1	2	1	2	1	2	1	2	2	2
3010	160	1	2	1	2	1	2	1	2	1	2	2	2
3011	170	1	2	1	1	1	2	1	0	1	1	1	4
3013	210	1	1	1	2	1	2	1	1	1	2	2	1
3014	190	1	1	1	2	1	2	1	1	1	2	2	1
3015	190	1	1	1	2	1	2	1	1	1	2	2	1
3016	160	1	1	1	2	1	2	1	2	1	2	2	2
3017	160	1	1	1	2	1	2	1	2	1	2	2	2
3018	200	1	2	1	2	1	2	1	2	1	2	2	2
3019	220	1	2	1	2	1	2	1	2	1	2	2	2
3020	110	1	2	1	1	1	2	1	0	1	2	1	4
3021	192	1	1	1	2	1	2	1	2	1	2	2	1

<u>KEY TO CODES</u>

FTC = Fuel Tank Capacity (gals)
EM = Engine Modification (1=yes)
AIR = Air Injection (1=yes, 2=no)
EGR = Exhaust Gas Recirculation (1=yes, 2=no)
FI = Fuel Injection (1=yes, 2=no)
CAT = Oxidation Catalyst (1=yes)
TR = Termal Reactor (2=no)
PCV = Positive Crankcase Ventilation (1-installed and functioning)
CBE = Carburetor Bowl Evaporative Emission Control 1=yes, 2=no, 0=not applicable)
FTE = Fuel Tank Evaporative Emission Control (1=yes)
CCC = Carbon Canister Contraction (1=open bottom, 2=closed bottom)
CC = Carbon Canister (1=all vapors enter bed, 2=running vapors bypass bed)
CCP = Carbon Canister Purges to (1-air cleaner, 2-carburetor, 3=PCV, 4-manifold)

003 CARD LISTING
VEHICLE USE INFORMATION

CAR NO.	1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	1ɩ	17	18	19	20	21	22	23	24
3001	1	2	3	41444	1444	1	15	414444	03	3	15	222222221	1	1	1	1	1	001	1	3	4	2	1	2	SHELL SUPER REG
3002	1	2	3	14444	1444	1	10	414444	02	1	182015	222222221	1	3	2	3	2	002	1	2	2	2	1	2	MOBIL CLEAR
3003	1	2	5	23444	2344	3	35	324444	02	3	15	222222221	1	3	2	1	1	001	1	3	4	2	1	2	MOBIL UNLD
3004	1	2	2	23434	1444	1	07	144444	02	1	161511	222222221	1	3	1	1	1	001	1	5	3	3	1	2	UNION UNLD
3005	1	2	4	14444	4441	1	03	414444	02	1	151712	222222221	1	3	2	3	2	018	1	2	2	2	1	2	SHELL UNLD
3006	1	1	2	23444	4144	1	20	441444	04	1		222222221	1	1	1	1	1	001	1	2	2	2	1	2	EXXON UNLD
3007	1	2	2	33344	3424	1	10	333444	10	3	232820	222222221	2	1	1	1	1	001	1	5	4	2	1	2	CHEVRON UNLEADED
3008	1	2	2	42344	2344	1	07	144444	02	2		221212222	2	3	1	1	1	001	1	3	4	2	1	2	FIRECHIEF
3009	1	1	2	43244	2444	1	15	234444	03	3		222222221	2	1	1	1	1	001	1	5	3	3	1	2	TEXACO
3010	1	2	2	41444	4243	3	12	441444	02	2	16	121212222	3	3	1	1	1	001	1	2	2	2	1	2	MOBIL UNLD
3011	1	1	2	32344	1444	1	14	144444	4	2	161115	222222221	1	3	1	1	1	001	1	3	3	3	1	2	TEXACO UNLEADED
3013	1	2	3	33344	3343	1	05	334444	03	1	161715	222222121	1	1	1	1	1	001	1	3	3	3	1	2	SHELL
3014	1	2	3	42344	1444	1	15	144444	8	2		221222221	1	6	3	3	6	002	1	2	2	2	1	2	FIRECHIEF
3015	1	3	3	23444	1444	3	10	144444	04	4	131510	122222222	2	4	2	3	2	010	1	5	3	3	1	2	UNION UNLD
3016	1	2	3	32444	1444	2	20	144444	04	1	20	2212222ɩ21	1	1	1	1	1	001	1	4	4	2	1	2	FEDCO
3017	1	1	4	13344	1343	3	10	134444	03	4	192114	222222221	1	1	1	1	1	001	1	2	2	2	1	2	EXXON UNLD
3018	1	3	5	41444	4243	3	18	414444	02	1	141814	222212222	2	3	2	3	3	040	1	5	4	2	1	2	STANDARD UNLD
3019	1	3	2	33444	3344	1	20	144444	2	3	151814	222222221	1	2	1	2	1	001	2	2	2	2	1	2	CHEVRON UNLD
3020	1	2	3	13444	3441	1	02	324444	03	4	23251ɐ	222222221	1	1	1	1	1	001	1	5	3	3	1	2	UNIƆN 76 REG
3021	1	2	2	33334	3424	3	40	234444	05	1		222222221	1	2	1	1	1	001	1	1	1	1	1	2	CHEVRON UNLD

Key: See sample questionnaire.

004 CARD LISTING

VEHICLE USE INFORMATION

CAR NO.	25	26	27	28	ODO START	ODO FINISH	ODO CHANGE	FUEL AMT	TIME	AMB TEMP
3001	1	2	222212	2	4764	4779	15	4	0745	57
3002	1	2	222212	2	10933	10943	10	1	0800	65
3003	1	2	222212	2	17752	17787	35	3	0800	57
3004	1	2	222212	2	04029	04036	7	2	0800	68
3005	1	2	222212	2	10252	10255	3	7	0820	64
3006	1	2	222212	2	01687	01707	20	2	1100	78
3007	1	2	222222	2	7249	7259	10	3	1000	70
3008	4	2	222212	3	06100	06107	7	2	0830	65
3009	1	2	122222	2	03224	03239	15	1	1045	75
3010	4	2	222212	2	02354	02366	12	2	0845	72
3011	1	2	222212	2	2132	2146	14	2	0925	70
3013	1	2	222212	2	5130	5135	5	2	0830	58
3014	1	2	222221	2	16068	16083	15	1	1715	71
3015	1	1	222212	2	11139	11149	10	3	1215	70
3016	1	2	222212	2	03740	03760	20	2	1205	68
3017	1	2	222212	2	4692	4702	10	3	0800	56
3018	1	2	222212	2	35969	35997	28	7	1200	74
3019	1	2	222212	2	13501	13521	20	3	0900	70
3020	1	2	222212	2	4337	4339	2	6	1215	69
3021	1	2	222212	2	7291	7321	30	3	1445	80

KEY: See sample questionnaire for Columns 25, 26, 27, and 28.

ODO Start, ODO Finish, ODO Change = Odometer readings from test vehicle prior to first test (no-preconditioning).

FUEL AMT = Approximate quantity of tank fuel upon receipt of vehicle prior to first test (in eighths of tank).

TIME = Time of result of vehicle prior to first test (24-hour clock).

AMB TEMP = Ambient temperature in the shade when vehicle was received (°F).

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3001	77/05/09	10	NL45C7G137289	77	DODG	ASPE	3	225	1	1	6	2	4000	12.0	2	4779

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.16	1	1245	5/10/77
HOT SOAK	5.82	1	1245	5/10/77
COMPOSITE	6.98	1	1245	5/10/77
DIURNAL	0.98	2	1248	5/11/77
HOT SOAK	4.79	2	1248	5/11/77
COMPOSITE	5.76	2	1248	5/11/77
DIURNAL	1.05	3	1254	5/13/77
HOT SOAK	3.92	3	1254	5/13/77
COMPOSITE	4.97	3	1254	5/13/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3002	77/04/18	12	HP41C7G102657	77	PLYM	VOLA	3	225	1	1	6	1	3500	12.3	1	10943

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.70	1	1220	4/19/77
HOT SOAK	1.64	1	1220	4/19/77
COMPOSITE	3.35	1	1220	4/19/77
DIURNAL	1.19	2	1222	4/20/77
HOT SOAK	0.91	2	1222	4/20/77
COMPOSITE	2.10	2	1222	4/20/77
DIURNAL	2.31	3	1227	4/26/77
HOT SOAK	1.28	3	1227	4/26/77
COMPOSITE	3.60	3	1227	4/26/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3003	77/05/09	10	WL46J7A110126	77	DODG	MONO	1	360	1	4	8	1	4500	14.0	1	17787

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.94	1	1247	5/10/77
HOT SOAK	1.48	1	1247	5/10/77
COMPOSITE	2.42	1	1247	5/10/77
DIURNAL	0.80	2	1253	5/12/77
HOT SOAK	1.38	2	1253	5/12/77
COMPOSITE	2.18	2	1253	5/12/77
DIURNAL	0.85	3	1255	5/13/77
HOT SOAK	1.67	3	1255	5/13/77
COMPOSITE	2.52	3	1255	5/13/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3004	77/04/25	09	SS2257R146706	77	CHRY	CORD	2	360	1	4	8	1	4500	14.0	1	4036

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	4.78	1	1228	4/26/77
HOT SOAK	3.55	1	1228	4/26/77
COMPOSITE	8.33	1	1228	4/26/77
DIURNAL	4.22	2	1231	4/27/77
HOT SOAK	1.55	2	1231	4/27/77
COMPOSITE	5.77	2	1231	4/27/77
DIURNAL	3.00	3	1234	4/28/77
HOT SOAK	1.62	3	1234	4/28/77
COMPOSITE	4.62	3	1234	4/28/77
DIURNAL	1.19	4	1282	6/15/77
HOT SOAK	2.18	4	1282	6/15/77
COMPOSITE	3.37	4	1282	6/15/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3005	77/05/23	09	CL41J7D113953	77	CHRY	NEWP	1	360	1	4	8	1	5000	14.7	1	10255

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	3.16	1	1262	5/24/77
HOT SOAK	1.84	1	1262	5/24/77
COMPOSITE	5.00	1	1262	5/24/77
DIURNAL	2.16	2	1265	5/25/77
HOT SOAK	1.42	2	1265	5/25/77
COMPOSITE	3.58	2	1265	5/25/77
DIURNAL	1.70	3	1268	5/26/77
HOT SOAK	2.25	3	1268	5/26/77
COMPOSITE	3.95	3	1268	5/26/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3006	77/06/01	10	WL46J7A174297	77	DODG	MONO	1	360	1	4	8	1	4500	14.0	1	1707

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.27	1	1274	6/ 2/77
HOT SOAK	1.52	1	1274	6/ 2/77
COMPOSITE	2.79	1	1274	6/ 2/77
DIURNAL	0.69	2	1280	6/ 8/77
HOT SOAK	1.82	2	1280	6/ 8/77
COMPOSITE	2.51	2	1280	6/ 8/77
DIURNAL	1.22	3	1281	6/ 9/77
HOT SOAK	1.45	3	1281	6/ 9/77
COMPOSITE	2.67	3	1281	6/ 9/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3007	77/04/25	03	1M27B72106656	77	CHEV	MONZ	4	140	5	2	4	1	3000	11.3	1	7259

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	12.55	1	1226	4/26/77
HOT SOAK	3.29	1	1226	4/26/77
COMPOSITE	15.85	1	1226	4/26/77
DIURNAL	1.83	2	1232	4/28/77
HOT SOAK	1.50	2	1232	4/28/77
COMPOSITE	3.34	2	1232	4/28/77
DIURNAL	3.44	3	1236	4/29/77
HOT SOAK	2.55	3	1236	4/29/77
COMPOSITE	5.99	3	1236	4/29/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3008	77/05/23	03	1V77B7U108266	77	CHEV	VEGA	4	140	4	2	4	2	2750	9.9	2	6107

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	2.90	1	1263	5/24/77
HOT SOAK	1.29	1	1263	5/24/77
COMPOSITE	4.20	1	1263	5/24/77
DIURNAL	0.40	2	1266	5/25/77
HOT SOAK	0.89	2	1266	5/25/77
COMPOSITE	1.29	2	1266	5/25/77
DIURNAL	0.60	3	1269	5/26/77
HOT SOAK	0.99	3	1269	5/26/77
COMPOSITE	1.59	3	1269	5/26/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3009	77/05/17	05	2C77V7U511414	77	PONT	ASTR	4	151	1	2	4	1	3000	11.3	1	3239

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.31	1	1271	6/ 1/77
HOT SOAK	1.55	1	1271	6/ 1/77
COMPOSITE	2.86	1	1271	6/ 1/77
DIURNAL	3.76	2	1273	6/ 2/77
HOT SOAK	1.55	2	1273	6/ 2/77
COMPOSITE	5.31	2	1273	6/ 2/77
DIURNAL	3.71	3	1276	6/ 3/77
HOT SOAK	1.48	3	1276	6/ 3/77
COMPOSITE	5.20	3	1276	6/ 3/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3010	77/05/17	05	2C77V7U510549	77	PCNT	ASTR	4	151	1	2	4	1	3000	11.3	1	2366

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	7.67	1	1272	6/ 1/77
HOT SOAK	1.54	1	1272	6/ 1/77
COMPOSITE	9.21	1	1272	6/ 1/77
DIURNAL	5.56	2	1275	6/ 2/77
HOT SOAK	1.56	2	1275	6/ 2/77
COMPOSITE	7.12	2	1275	6/ 2/77
DIURNAL	0.51	3	1278	6/ 3/77
HOT SOAK	1.29	3	1278	6/ 3/77
COMPOSITE	1.80	3	1278	6/ 3/77
DIURNAL	5.14	4	1283	6/15/77
HOT SOAK	1.84	4	1283	6/15/77
COMPOSITE	6.98	4	1283	6/15/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3011	77/04/26	14	HLS30363522	77	DATS	280Z	4	168	1	0	6	1	3000	11.3	1	2146

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.72	1	1230	4/27/77
HOT SOAK	2.44	1	1230	4/27/77
COMPOSITE	4.15	1	1230	4/27/77
DIURNAL	0.70	2	1233	4/28/77
HOT SOAK	0.89	2	1233	4/28/77
COMPOSITE	1.59	2	1233	4/28/77
DIURNAL	0.68	3	1235	4/29/77
HOT SOAK	0.93	3	1235	4/29/77
COMPOSITE	1.60	3	1235	4/29/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3013	77/05/09	01	4B69C7L108409	77	BUIC	SKYL	3	231	1	2	6	1	3500	12.3	1	5135

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.20	1	1246	5/10/77
HOT SOAK	4.96	1	1246	5/10/77
COMPOSITE	6.16	1	1246	5/10/77
DIURNAL	0.75	2	1249	5/11/77
HOT SOAK	4.18	2	1249	5/11/77
COMPOSITE	4.94	2	1249	5/11/77
DIURNAL	1.02	3	1252	5/12/77
HOT SOAK	4.53	3	1252	5/12/77
COMPOSITE	5.56	3	1252	5/12/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3014	77/04/20	06	F6K91L172869F	76	FORD	MAVE	3	250	1	1	6	2	3000	10.3	2	16083

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	12.90	1	1224	4/21/77
HOT SOAK	11.89	1	1224	4/21/77
COMPOSITE	24.80	1	1224	4/21/77
DIURNAL	4.04	2	1225	4/22/77
HOT SOAK	12.55	2	1225	4/22/77
COMPOSITE	16.59	2	1225	4/22/77
DIURNAL	7.27	3	1229	4/26/77
HOT SOAK	13.30	3	1229	4/26/77
COMPOSITE	20.57	3	1229	4/26/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3015	77/05/17	06	F6K91L154923F	76	FORD	MAVE	3	250	1	1	6	1	3000	11.3	1	11149

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.35	1	1258	5/18/77
HOT SOAK	14.85	1	1258	5/18/77
COMPOSITE	15.20	1	1258	5/18/77
DIURNAL	2.25	2	1260	5/20/77
HOT SOAK	15.43	2	1260	5/20/77
COMPOSITE	17.69	2	1260	5/20/77
DIURNAL	1.17	3	1261	5/23/77
HOT SOAK	19.11	3	1261	5/23/77
COMPOSITE	20.28	3	1261	5/23/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3016	77/05/23	03	1V77B6U126154	76	CHEV	VEGA	4	140	1	2	4	1	2750	10.9	1	3760

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.55	1	1264	5/24/77
HOT SOAK	0.93	1	1264	5/24/77
COMPOSITE	1.48	1	1264	5/24/77
DIURNAL	0.66	2	1267	5/25/77
HOT SOAK	0.79	2	1267	5/25/77
COMPOSITE	1.45	2	1267	5/25/77
DIURNAL	0.73	3	1270	5/26/77
HOT SOAK	0.84	3	1270	5/26/77
COMPOSITE	1.57	3	1270	5/26/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3017	77/03/21	03	1V15B6U225373	76	CHEV	VEGA	4	140	1	2	4	1	3000	11.3	1	4702

EVAPORATIVE TEST RESULTS

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.47	1	1204	3/22/77
HOT SOAK	0.70	1	1204	3/22/77
COMPOSITE	1.17	1	1204	3/22/77
DIURNAL	0.94	2	1206	3/23/77
HOT SOAK	0.63	2	1206	3/23/77
COMPOSITE	1.57	2	1206	3/23/77
DIURNAL	0.53	3	1208	3/24/77
HOT SOAK	1.08	3	1208	3/24/77
COMPOSITE	1.60	3	1208	3/24/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3018	77/05/04	04	3J57K5R157191	75	OLDS	CUTL	2	350	1	4	8	1	4000	13.2	1	55997

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.93	1	1242	5/ 5/77
HOT SOAK	1.45	1	1242	5/ 5/77
COMPOSITE	2.38	1	1242	5/ 5/77
DIURNAL	0.73	2	1243	5/ 6/77
HOT SOAK	1.32	2	1243	5/ 6/77
COMPOSITE	2.05	2	1243	5/ 6/77
DIURNAL	4.06	3	1244	5/ 9/77
HOT SOAK	1.44	3	1244	5/ 9/77
COMPOSITE	5.50	3	1244	5/ 9/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3019	77/03/25	04	3K57K5R163417	75	OLDS	CUTL	2	350	1	4	8	1	4000	13.2	1	13521

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	0.29	1	1237	5/ 3/77
HOT SOAK	1.25	1	1237	5/ 3/77
COMPOSITE	1.54	1	1237	5/ 3/77
DIURNAL	0.35	2	1239	5/ 4/77
HOT SOAK	1.70	2	1239	5/ 4/77
COMPOSITE	2.05	2	1239	5/ 4/77
DIURNAL	0.34	3	1247	5/ 5/77
HOT SOAK	1.88	3	1247	5/ 5/77
COMPOSITE	2.21	3	1247	5/ 5/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3020	77/03/07	16	1162160836	76	VOLK	SEDA	4	97	4	0	4	2	2000	8.3	2	4339

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	1.66	1	1201	3/ 8/77
HOT SOAK	2.02	1	1201	3/ 8/77
COMPOSITE	3.68	1	1201	3/ 8/77
DIURNAL	2.30	2	1202	3/ 9/77
HOT SOAK	1.66	2	1202	3/ 9/77
COMPOSITE	3.96	2	1202	3/ 9/77
DIURNAL	1.35	3	1203	3/10/77
HOT SOAK	1.98	3	1203	3/10/77
COMPOSITE	3.32	3	1203	3/10/77

CAR NO.	DATE	MAKE CODE	VIN	YR	MAKE	MODL	MOD SIZ	CID	TR	CV	NO. CYL	AC	INRT WT	ROAD HP	A/C SIM	ODOM
3021	77/03/23	06	6W82F296163	76	FORD	GRAN	3	302	1	2	8	1	3500	12.3	1	7321

. EVAPORATIVE TEST RESULTS .

CYCLE	GRAMS (HC)	TEST NO.	RUN NO.	DATE
DIURNAL	3.93	1	1210	3/28/77
HOT SOAK	12.05	1	1210	3/28/77
COMPOSITE	15.98	1	1210	3/28/77
DIURNAL	3.91	2	1213	3/30/77
HOT SOAK	11.65	2	1213	3/30/77
COMPOSITE	15.56	2	1213	3/30/77
DIURNAL	4.23	3	1214	4/ 1/77
HOT SOAK	12.60	3	1214	4/ 1/77
COMPOSITE	16.83	3	1214	4/ 1/77

10-MINUTE ROAD ROUTE

Task Order - EPA Contract No. 68-03-2412

Cerritos Avenue west to Anaheim Boulevard. Anaheim Boulevard north to Ball Road. Ball Road east to State College Boulevard. State College Boulevard south to Katella Boulevard. Katella Boulevard west to Lewis Street. Lewis Street north to Cerritos Avenue, Cerritos Avenue west to Olson facility. Total elapsed distance is 4.5 miles.

SHED TASK ORDER
FID SNIFFER TEST

VEHICLE NO. 3014 DATE 4-28-77 PIC VALENCIA

	Deflections	Range	Concentration
Measure HC through FID at each location before LA-4:			
Fuel Cap	@ 16.0	100	17.4
Inside Trunk	@ 11.0	100	11.78
Carbon Canister	@ 30.0	100	31.49
Carb. Air Horn	@ 11.2	100	12.0
Around Base of Air Cleaner Canister	@ 60.0	100	61.0
Measure HC through FID at each location immediately after LA-4:			
Fuel Cap	@ 40.0	300	120
Inside Trunk	@ 4.0	300	12
Carbon Canister	@ 40.0	300	120
Carb. Air Horn	@ 30.0	300	90
Around Base of Air Cleaner Canister	@ 40.0	1000	400
Measure HC through FID at each location 15 minutes after LA-4:			
Fuel Cap	@ 4.0	300	12
Inside Trunk	@ 4.0	300	12
Carbon Canister	@ 50.0	300	150
Carb. Air Horn	@ 15.0	300	45
Around Base of Air Cleaner Canister	@ 85.0	3000	2551

SHED TASK ORDER
FID SNIFFER TEST

VEHICLE NO. 3015 DATE 5-24-77 PIC Valenzuela

	Deflections	Range	Concentration
Measure HC through FID at each location before LA-4:			
Fuel Cap	@ 4.5	100	4.85
Inside Trunk	4.5	100	4.85
Carbon Canister	5.5	100	5.92
Carb. Air Horn	11.0	100	11.78
Around Base of Air Cleaner Canister	45.0	1000	450
Measure HC through FID at each location immediately after LA-4:			
Fuel Cap	@ 6.0	100	6.46
Inside Trunk	5.0	100	5.39
Carbon Canister	6.0	100	6.46
Carb. Air Horn	5.0	100	5.39
Around Base of Air Cleaner Canister	14.0	10K	1393.9
Measure HC through FID at each location 15 minutes after LA-4:			
Fuel Cap	@ 10.0	100	10.72
Inside Trunk	9.0	100	9.66
Carbon Canister	10.0	100	10.72
Carb. Air Horn	7.0	100	7.53
Around Base of Air Cleaner Canister	18.0	10K	1195.8

SHED TASK ORDER
FID SNIFFER TEST

VEHICLE NO. 3021* DATE ______ PIC #1

	Deflections	Range	Concentration
Measure HC through FID at each location before LA-4:			
Fuel Cap	16	50	8
Inside Trunk	11	50	5
Carbon Canister	14	50	7
Carb. Air Horn	10	50	4
Around Base of Air Cleaner Canister	300	10	30
Measure HC through FID at each location immediately after LA-4:			
Fuel Cap	18	100	18
Inside Trunk	6	100	6
Carbon Canister	5	100	5
Carb. Air Horn	5	100	5
Around Base of Air Cleaner Canister	36	300	108
Measure HC through FID at each location 15 minutes after LA-4:			
Fuel Cap	9	100	9
Inside Trunk	6	100	6
Carbon Canister	4	100	6
Carb. Air Horn	6	100	6
Around Base of Air Cleaner Canister	70	1000	700

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-460/3-77-013	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Effect of Preconditioning on In-Use Vehicle Testing and Failure Analysis of Evaporative Emission Control Systems		5. REPORT DATE August 1977
		6. PERFORMING ORGANIZATION CODE
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9. PERFORMING ORGANIZATION NAME AND ADDRESS Olson Laboratories, Inc. 421 East Cerritos Avenue Anaheim, California 92805		10. PROGRAM ELEMENT NO.
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

Evaporative (SHED) and exhaust emission tests were performed on 20 late-model catalyst-equipped vehicles to investigate the effect of three preconditioning procedures consisting of: 1) no preconditioning, 2) 1975 FTP driving schedule, and 3) 10-minute road route. A failure analysis was also performed on several vehicles which were found to either have high evaporative emissions or evaporative emissions which were higher than similarly equipped vehicles.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

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