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MASTER

TEST PLAN

for

RELIABILITY FLEET TESTING OF ALCOHOL/GASOLINE BLENDS

DOE/CS/50004--T3

Prepared for the

U.S. Department of Energy
Office of Conservation and Solar Applications
Office of Transportation Programs

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by

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1.0 INTRODUCTION

1.1. Background

The Alternative Fuels Utilization Program (AFUP) of the Office of Transportation Programs (TP), Department of Energy (DOE), addresses several options as petroleum replacements for highway vehicles. At this time, the AFUP effort is concentrating on alcohol fuels with the goal of bringing the end-use technology for alcohol/gasoline blends to the point of commercial readiness by 1982-83. The Reliability Fleet Test Project (1) is the last step in achieving this state of readiness for such blends.

The project entails the operation of both government and private fleets at multiple locations across the country over a three-year period (FY1980-1982). The first fleets will operate on presently marketed Gasohol using 1975-1979 model year vehicles. Subsequent fleets will include 1980 and later vehicles modified to operate on 10 volume percent ethanol and/or methanol gasoline blends formulated to meet certain fuel specification.

In order to encompass the greatest number of fleets in the program while accommodating the variation in ability of such participants to adhere to the desired operating procedures and controls, three categories of fleets have been defined. Participating Fleets will most closely follow the guidelines established in this Test Plan and will thus provide the primary data base. Affiliated Fleets will operate essentially in accordance with Test Plan requirements but may not be in a position to provide all of the required services or controls. Fleet operations differing substantially from those specified in this document will be included in the Cooperative Fleet category.

1.2 Purpose

The purpose of this Test Plan is to provide a common set of procedures and controls to govern the operation of the various fleets in the Reliability Project. The intent of these procedures is to achieve uniform practices with minimum changes to the fleet operation existing operating practices. The Plan serves as a basis for discussions with candidate fleet operators by defining in detail the test activities and level of performance sought.

1.3 Scope

This Test Plan covers the operational and reporting procedures associated with the fleet vehicles and supporting facilities, the latter encompassing both the garage/fueling complex and the emissions/fuel economy test facility. The operational instructions and

1. "Project Plan for Reliability Fleet Testing of Alcohol/Gasoline Blends," prepared by The Aerospace Corporation for the U.S. Department of Energy, Office of Transportation Programs (March 30, 1979).

requirements provide for pretest and daily fleet activities; vehicle maintenance and replacement; fuel surveillance; and dynamometer testing for emissions and fuel economy on a chassis dynamometer.

It is intended that this Plan will be applicable to both 1975-79 vehicles and post-1979 modified vehicles as the latter become available. Also, the Plan will provide for the use of various ethanol and/or methanol blends as they are incorporated into the Project in the future. To maintain such flexibility, the document will be updated as necessary, particularly with respect to the issuance of additional attachments to cover new equipment, fuels or operating conditions.

1.4 Deviation Approvals

In general, it is expected that most points of nonconformance with the requirements of this Plan will have been discussed with the potential operator prior to fleet acceptance and start of operations. Minor differences, which can be agreed to by memorandum, should not affect the classification of the particular fleet. However, inability to satisfy major requirements of the Plan could result in assignment of the fleet to a category below the Participating Fleet level.

After the initiation of fleet operations, deviations from the specified requirements should be coordinated through the Operating Group Manager.

2.0 FLEET DESCRIPTION

This section prescribes the information to be furnished by each fleet operator with regard to the vehicles under his control that are assigned to the reliability test project. Much of this information may have been furnished during preliminary negotiations for fleet acceptance in the project and need not be resubmitted except for necessary updating. As with the other data called for in this Plan, the primary recipient of all such submittals is the Operating Group Manager.

2.1 Vehicle Identification Data

The fleet operator shall furnish initially a sufficient description of each vehicle to facilitate subsequent interpretation of test data as the project proceeds. As a minimum, the following information should be provided for each vehicle in the Test and Control fleets:

1. Manufacturer, model and serial no., model year, engine size, license number;
2. Vehicle equipment, e.g. automatic transmission, air conditioning, alcohol fuel modifications if any;
3. Odometer reading at start of test operations.

2.2 Maintenance Data

The following maintenance information should be furnished for each fleet vehicle from company records when available:

1. Data mileage at last tune-up or major overhaul and work accomplished;
2. Data and mileage at last lube oil change, whether filter was also changed, and type of oil charged;
3. If available from gasoline usage records, recent fuel economy.

2.3 Vehicle Location

The base location of each fleet vehicle shall be provided, i.e., at which company facility the vehicle is usually kept overnight, also whether it is parked indoors when not in use.

2.4 Test/Control Fleet Assignments

The fleet operator shall identify which component of the fleet (Test or Control) each vehicle is assigned. Such assignments should be accomplished after consultation with the Operating Group Manager to assure proper balance of the Test and Control fleets and to permit meaningful comparisons to be made.

2.5 Duty Cycle

The fleet operator shall specify for each vehicle a short description of the duty cycle. Terminology will be provided by the Operating Group Manager for uniformity but will typically cover the following points:

1. Route type, i.e., urban, freeway, stop/start;
2. Frequency of usage, i.e., daily versus occasional;
3. Assigned or casual driver.

3.0 FACILITY DESCRIPTION

This section identifies the facility information to be supplied by the fleet operator prior to initiation of actual reliability fleet operations. As discussed at the beginning of the previous section, much of these data may have been furnished early in the negotiations, in which case the following can serve as a check list.

3.1 Fleet Facility Physical Description

The fleet operator shall provide a physical description of his facility to include at least the following information:

1. Size of fleet garage(s), particularly available parking spaces and whether heated;

2. Description of tanks for fuel storage as to location, capacity, materials, age, condition, and previous use.
3. Description of fueling (vehicle fill) pump as to make, age, condition, date of last filter change, date of last calibration.

3.2 Fleet Facility Personnel Complement

The primary information desired in this area relates to the number and types of personnel who will be associated with the fleet test program. Of particular interest is the expertise of the drivers, maintenance mechanics, and the recordkeeping clerk.

3.3 Maintenance Capability

The fleet operator shall indicate whether vehicle maintenance will be accomplished in-house by maintenance employees or provided by outside service. With regard to in-house capability, the operator shall furnish information on test equipment available in the shop, the level of maintenance and repair services customarily provided, and any special expertise useful for the test project.

3.4 Emissions/Fuel Economy Test Facilities

The name and location of the dynamometer facility that is to provide emissions and fuel economy testing of fleet vehicles will be identified and its capability described. In general, selection of such a test facility will be arrived at by mutual consent between the operator and the Operating Group Manager. In the case of nationally recognized facilities, a detailed description is unnecessary but such information is mandatory for university and local government facilities.

4.0 PRETEST PREPARATIONS

Proper procedures to prepare the fleet vehicles and facility equipment for inauguration of blend testing are prerequisites for a successful program. This section describes the measures that have been found to be necessary or prudent based on alcohol fuel testing to date. Inasmuch as the fleets and fleet facilities will differ widely in makeup and operating features, the procedures presented herein should be adopted for the particular local conditions at the operating site.

4.1 General Activities

There are several preparatory activities that are not associated with either the vehicles or the facility but are nevertheless important considerations in initiating this type of project. A minimum list of such items is given below.

1. Local regulatory approvals - If State/Local approvals are required, the Operating Group Manager will assist in obtaining such approvals.

2. Personnel instructions - Various company personnel will have to received instructions regarding their participation in the project. Safety information should be circulated to affected personnel, particularly prior to methanol being introduced. Instructions must be given for filling out the driver forms, maintenance logs and fueling logs if not previously utilized. By relating the project to the national energy shortage, some motivation should be introduced for personnel to use care in completing these forms.

4.2 Storage Tanks (Underground)

The following items will be accomplished prior to program initiation:

- o Drain tank and air dry for 2 days
- o Install new filters in pumps
- o Calibrate dispersing pump

4.3 Fuel Tank (Auto)

Prior to vehicles being placed on the test program, the following will be accomplished:

- o Run fuel tank down to $\frac{1}{4}$ or below.
- o Test drive each vehicle by qualified driver/observer to insure acceptable performance.
- o Oil filter/fuel filter replacement in accordance with manufacturer recommendations and/or current operating practices.

5.0 ROUTINE VEHICLE OPERATIONS

5.1 Fueling Ratio

The following information will be recorded by the driver and/or gas island attendant at each vehicle fueling and appropriately recorded on the driver daily log and/or fuel log sheet (shown in Appendix A):

- o Vehicle identification
- o Date
- o Mileage
- o Gallons used

5.2 Driver Reports

These reports (shown in Appendix A) will be completed and turned in daily by each driver.

5.3 Maintenance

Current maintenance practices should be maintained. However, the following additional items should be incorporated:

- o Fuel-related engine maintenance will be recorded on the maintenance log sheet as shown in appendix B.
- o A 4-oz oil sample will be collected from the crankcase drain at every oil change. Vehicle ID, mileage and date will be supplied with every oil sample.

5.4 Problem Reporting Procedures

All engine related problems will be reported immediately using the following reporting system:

Addresses and telephone numbers of Key personnel are:

Operating Group Manager

Southwest Research Institute
Attn: Mr. John D. Tosh
P.O. Drawer 28510
San Antonio, TX 78284
512-684-5111, ext 2576

Project Manager

The Aerospace Corporation
Attn: Mr. Russell Raymond
Suite 4000
955 L'Enfant Plaza, S.W.
Washington, D.C. 20024
202-488-6037

6.0 EMISSION/FUEL ECONOMY TESTS

6.1 Test Procedures

The standard FTP test normally used for vehicle certification will be utilized for selected vehicles in fleets located in areas where emissions testing capability is available and contracting can be secured. This test procedure may be modified as necessary with coordination between the Operating Group Manager, Project Manager, and DOE Program Manager.

Fuel economy measurements will be made in conjunction with the FTP emission tests (if fuel measurement capability exists). These measurements will be made with both unleaded gasoline and the alcohol/gasoline blend on each of the selected vehicles.

6.2 Test Frequency

Frequency of testing will depend on capability of emission testing facility and the availability of the fleet vehicles. However, a minimum should be once early in the program and once prior to program termination.

7.0 FUEL ANALYSIS

7.1 Fuel Analysis Procedure

Analyses will be conducted on periodic fuel samples in accordance with the suggested analytical procedures included as Appendix C.

8.0 DATA REPORTING

8.1 Required Forms (Discussed in Section 5)

- o Driver Log (daily)
- o Fuel/mileage Logs (as required)
- o Maintenance Log (as required)

Sample forms are shown in Appendix A and B

8.2 Frequency of Submission

Above reports will be accumulated and mailed bi-monthly to:

Southwest Research Institute
P.O. Drawer 28510
San Antonio, TX 78284
Attn: Mr. John D. Tosh

9.0 VEHICLE REPLACEMENT

The three-year duration of the reliability fleet test program and the minimum participating time for each fleet of one year makes it reasonable to expect some turnover of vehicles during the test period, especially for the unmodified, pre-1980 vehicles. If replacements are not too numerous and replacement operations are accomplished in an orderly manner, the statistical data from the fleet will not be appreciably degraded and, in some instances, could be enhanced. This section delineates the procedures to be followed to minimize the impact of vehicle turnover on the test program.

9.1 Notification of Intended Replacement

In most instances, vehicle replacement is a planned function which can be foreseen far in advance. Expected turnovers may even be known at the time of exploratory discussions between the prospective fleet operator and the Operating Group Manager. In all these cases, it is necessary and relatively easy for the operator to keep the Operating Group Manager informed in a timely manner of the details of pending vehicle replacements. Notice is required so that the impact on fleet data can be assessed, initial preparation of the new vehicle planned, and final testing of the old vehicle scheduled. If any modified vehicle must be replaced, it will probably be necessary to procure the replacement from the manufacturer through the Operating Group Manager.

In addition to planned replacements, there may be emergency situations that cannot be foreseen, e.g., a major vehicle accident or a stolen car. The Operating Group Manager should be informed of such an occurrence as soon as possible, especially if he must expedite delivery of a modified vehicle.

The notification, preferably in writing or confirmed in writing, shall clearly identify the specific vehicle(s) that will be replaced and describe the replacement vehicle to the degree provided in Section 2.1.

9.2 Final Testing Requirements

Upon notification of a pending vehicle replacement, the Operating Group Manager shall confer with the fleet operator to determine if any final testing or inspection should be accomplished. Such activities may not be required if they had recently been accomplished. If the last test of the vehicle had been conducted at a considerable time in the past, the test schedule should be revised to allow a final complete test and inspection sequence to be performed.

APPENDIX A

Refueling Log Sheet and Driver Log Sheet

Refueling Log Sheet

Date _____

Fleet Operator _____

Location _____

Vehicle No. _____

Odometer Reading _____

Fuel, gal _____

Oil, qts _____

Was vehicle refueled with other than test fuel? Yes No

(For Gas Island Attendant Use Only)

DOE RELIABILITY FLEET TEST

Daily Log Sheet

Vehicle No. _____ Type _____ Date _____

Fleet Operator & Location _____ Driver's Name _____

Daily Mileage

End Miles _____

Starting Miles _____

Services

Fuel: No., gals _____

Oil: No., qts _____

Maintenance Req., Yes _____ No _____

Was vehicle refueled with other
than Test Fuel? Yes _____ No _____

Did you have problems with
any of the following -
if so, indicate severity:

Mildly
AnnoyingVery
Troublesome

1) Overall, performance problems were

☐☐

2) Cranking required to start engine

☐☐

3) Stalled after starting

☐☐

4) Idle roughness

☐☐

5) Stalls in traffic

☐☐

6) Hesitation, bucking, or coughing

☐☐

7) Lack of power

☐☐

8) Regardless of your opinion of severity, if problems 5, 6, or 7 occurred,
describe the type of driving, time of occurrence, and approximate
temperature condition: _____

Other Comments: _____

APPENDIX B

Maintenance Log Sheets

DOE RELIABILITY FLEET TEST

Maintenance History

Fleet Operator _____

Vehicle No. _____

Location _____

Date _____

Odometer

[illegible]

APPENDIX C

Fuel Analysis Procedure

Fuel Analysis Procedure

The following will be conducted routinely on fuel samples shipped to Southwest Research Institute. Other analyses will be conducted if deemed necessary.

<u>Analysis</u>	<u>Method</u>
Boiling Point Distribution	ASTM Method D 2887
Alcohol Content	SOHIO Research Gas Chromatograph Method
Water Content	ASTM D 1744 (Karl Fischer)