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An Evaluation of the Worcester Polytechnic Institute Steam Car

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Emission Control Technology Division
Office of Air and Water Programs
Environmental Protection Agency

Background

Under a grant from the Environmental Protection Agency, several participants in the August 1970 Clean Air Car Race (CACR) were offered contracts for additional vehicle testing. These contranct were offered as prizes to the participants in each of several vehicle categories.

The Worcester Polytechnic Institute steam car was able to cross the starting line but was unable to complete the race due to lack of speed and reliability. However, even though their accomplishments were modest they were sufficiently successful in their category to receive a contract for vehicle performance and emission testing at the EPA emission test facility in Ann Arbor, Michigan.

Vehicle Tested

The steam system was a modified version of a design by Richard J. Smith Automotive Steam Systems, employing a monotube steam generator and a six cylinder uniflow expander of the single action type. The system was built at WPI by a student group and installed in a 1970 Chevelle body. The original engine and transmission were removed and the steam system was installed in the vehicle engine compartment. Power was transferred by direct drive with no clutch.

Test Program

The car was delivered to the Ann Arbor laboratory on December 28, 1972. Since the vehicle burned fuels containing heavy hydrocarbons, emission testing would be accomplished by using the proposed 1975 Federal Test Procedure (FTP) for light duty Diesel vehicles. Performance testing would be for vehicle acceleration times (0-30 mph, 0-45 mph, and 20 to 50 mph) and maximum cruise speed.

Results

Due to numerous leaks and mechanical problems (see attachment), testing was terminated February 28, 1973, without any performance or emission testing. The vehicle had by then experienced its second high pressure blowout, showed considerable combustion chamber heat erosion, and was probably having major expander or pump problems.

Conclusions

Although the vehicle accumulated two hours of time (including one hour on the steam generator) during repairs, no quantitative or qualitative conclusions could be made about the system.

Recommendations

The person most knowledgable about the vehicle, a student, was attending school. In addition, WPI acknowledged that the vehicle needed considerable improving. These added considerably to the burden of testing a relatively untried system. This serves to reinforce EPA's present policy that testing of unconventional vehicles, unproven vehicle configurations, and new components at EPA must be preceded by sufficient data indicating that the desired results are achievable, the system is reliable, and sufficient resources are available to support testing.

SUMMARY OF SIGNIFICANT PROBLEMS AND EVENTS

Six leaks in low pressure steam lines required repair.

Two blowouts at same place in high pressure steam line (in generator - no safety hazards); repaired once.

Condenser boils over easily.

Inaccessability of portions of system.

Misadjustments of chains, fuel settings (repaired).

Susceptibility to failures.

Inability to move car under own power (after first high pressure blowout was repaired)

Significant overheating and erosion of combustion chamber and air breather.

Exhaust fumes in passenger compartment.