

PROGRESS REPORT NO. 7

KINETICS OF OXIDATION AND QUENCHING OF COMBUSTIBLES
IN EXHAUST SYSTEMS OF GASOLINE ENGINES

D. J. PATTERSON

PERIOD: SEPTEMBER 1, 1969 to SEPTEMBER 30, 1969

SEPTEMBER 1969

This project is under the technical supervision of the:

Coordinating Research Council
APRAC-Cape 8-68 Steering Committee

and is work performed by the:

Department of Mechanical Engineering
The University of Michigan
Ann Arbor, Michigan

Under Contract No. CAPE-8-68(1-68)-CRC
and Contract No. CPA-22-69-51-HEW

LONG-RANGE OBJECTIVES

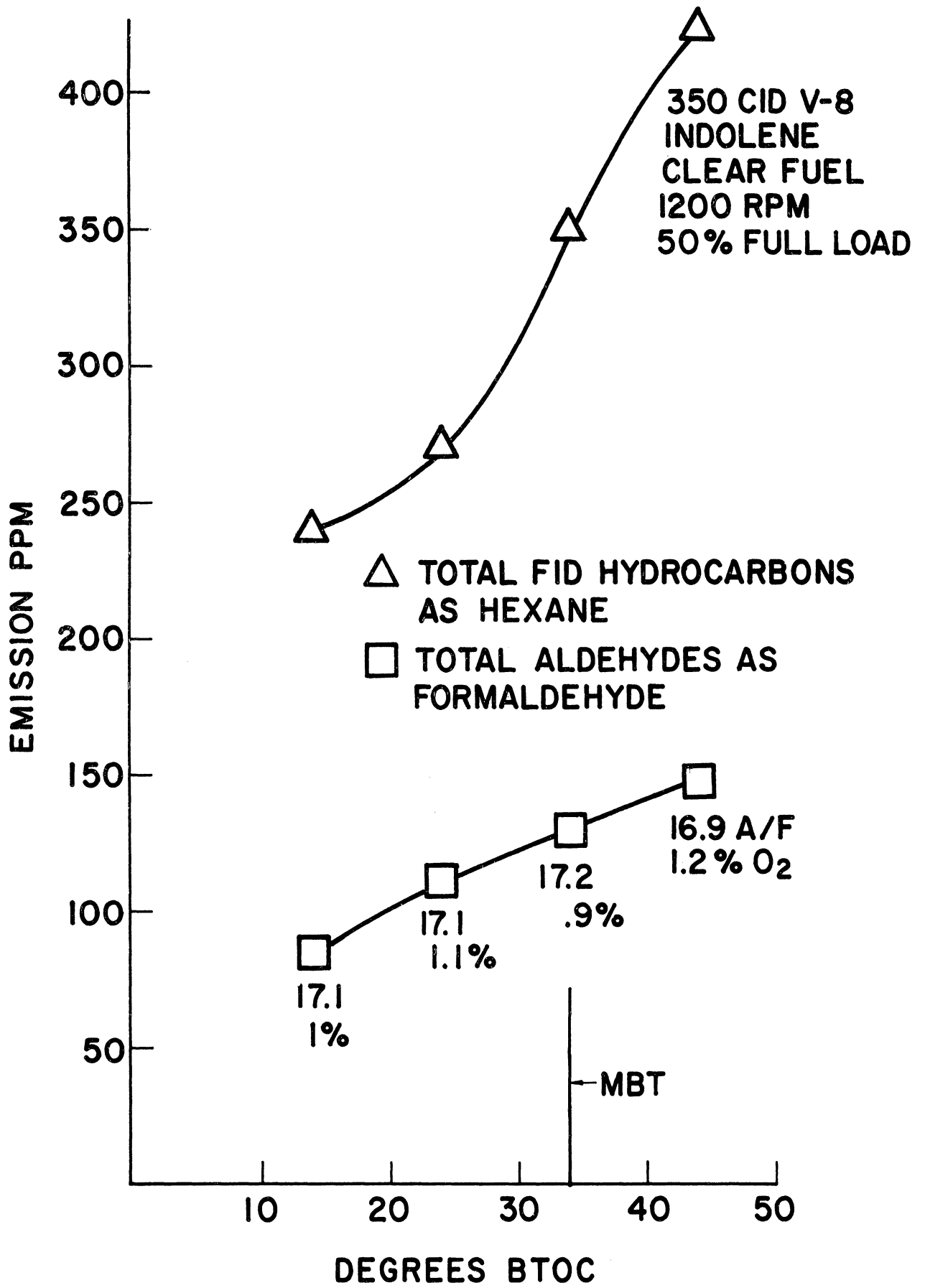
It is well-known that a significant amount of CO and unburned fuel may be consumed in the exhaust system of gasoline engines. Such combustion phenomena in exhaust reactors may be used to advantage to reduce the emission of these undesirable constituents. This process is the basis of exhaust air injection systems currently installed on some automobiles.

The overall objectives of this three-year research program are:

- To determine the chemical and physical processes which affect the emission characteristics of exhaust reactors installed on selected typical engines operating at various conditions on a dynamometer test stand.
- To identify the chemical species and significant chemical reactions present before, within, and after the reactor.
- To obtain information which will be helpful in predicting the design of the next generation of gasoline engine exhaust reactors.

PHASE I PROGRESS

Additional engine tests were run in order to check out procedures and equipment, and determine emission levels from the standard 350 CID Chevrolet engine. In some of this work aldehyde measurements were made at the wye using the DNPH Method. The following figure shows DNPH aldehydes as formaldehyde and hydrocarbons as hexane measured by a flame ionization detector. The hydrocarbon measurement was made at the muffler outlet. The engine was run at 1200 rpm, 50 percent full load with a lean mixture. The measured



air-fuel ratio is indicated on the curve. More data will be taken on the standard engine.

The subtractive column analyzer has been completed. Next an evaluation will be made with known calibration gases.

PHASE II PROGRESS

Preliminary studies aimed toward developing a first generation reactor model continue. The literature search continues. A trip to Mobil Scientific Laboratory was made to discuss their modeling approach.

PHASE III PROGRESS

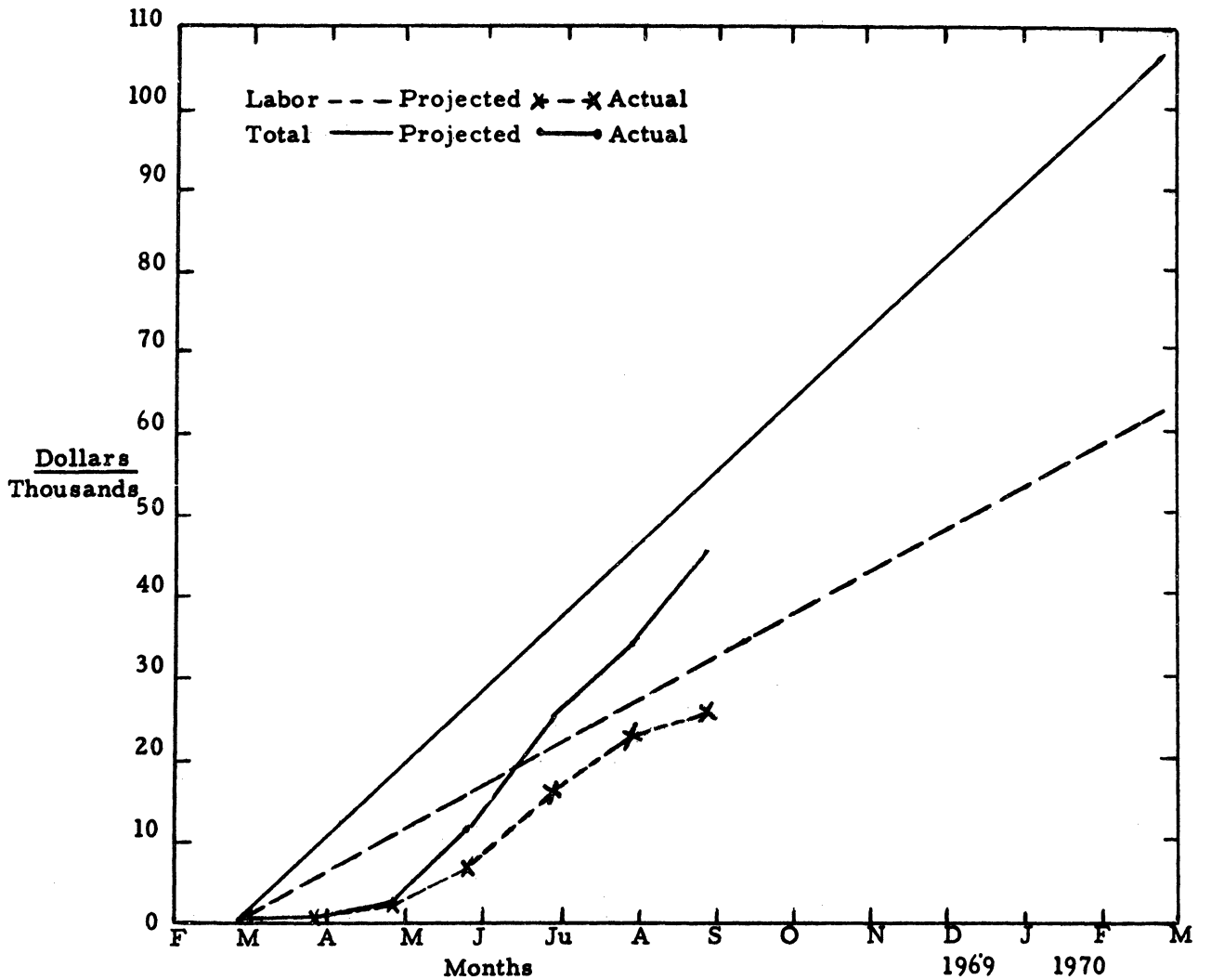
Studies of both timed and continuous sampling techniques continue. The electronic control for the timed sampler is still being debugged. Some preliminary timed sampling measurements have been made at the port of a single cylinder CFR engine using the breaker point control system.

Work is in progress to restore the Perkin-Elmer 800 gas chromatograph in our laboratory to good operating conditions. It is hoped this unit will suffice for the G. C. analyses required.

CRC CAPE 8-68 PROGRAM

OVERALL FINANCIAL SUMMARY

Program Total: February 24, 1969 - February 23, 1970	\$106,455
Cumulative Expenditures through August 24, 1969	<u>44,784</u>
Balance	\$ 64,671



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