

ETHYL GASOLINE CORPORATION

CHEMICAL RESEARCH LABORATORY

7600 WEST EIGHT MILE ROAD

DETROIT, MICHIGAN

October 10, 1940

Dr. Robert A. Kehoe
College of Medicine
University of Cincinnati
Cincinnati, Ohio

Dear Dr. Kehoe:

Dr. Calingaert has asked me to answer your letter to him of October 1, in which you ask for "some of the data in support of the statements" in my letter of May 25 regarding the lead content of exhaust gases. Frankly, it is not clear to me just what you want here - whether you question the accuracy of some of the statements, or whether you simply want further information as to how they were arrived at. In any event, following are some references and specific figures, numbered to correspond to my previous letter; if you will let me know specifically what additional information you would like, I shall try to get it for you.

1. The Bureau of Mines 1927 report "Experimental Studies...", pages 345-8 describes the Cottrell precipitator used in this work. This apparently was effective at the low rate of sampling used, that is, 0.5 cubic feet per hour out of a total of 30,000 cubic feet per hour (page 45).

2. Attached is an oil analysis data sheet, taking 0.803% by weight lead in the oil, times 1.5 gallons oil, times 7.76 pounds per gallon, gives a total of 42 grams lead in the oil; taking a 2000 mile oil drain period, and assuming 12 miles per gallon of fuel, gives 166 gallons of fuel used per oil sample, at 3.00 cc. TEL per gallon gives 523 grams lead; dividing this into 42 grams gives 8%.

3. See the Bureau of Mines report, pages 29-32; current air-fuel ratios are much leaner than were in use in 1921, giving a carbon monoxide content of about 1.5-2%.

4. Analyses of condensate water from exhaust pipe (Chemical Research Labs. No. 202-M-3529, 3384) showed a wide variation in lead content, from less than 1 to 50 mg./liter, the high values evidently being due to the presence of solids in the sample taken. An analysis of a filtered composite sample from a 1937 Chevrolet car fitted with a special exhaust gas condenser, is attached.

5. Some typical engine deposit analyses are given in the Bureau of Mines report, pages 49-51.

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6. No data.

7. A recalculation of the vapor pressure of lead bromide gives 10^{-14} mm. at 27° C., correct within a factor of 1000. The estimate was made from data in I.C.T. on the vapor pressures of liquid lead chloride and lead bromide, their melting points and heats of fusion, and on the vapor pressure of solid lead chloride: details will be furnished if desired.

8 - 11. No data.

Very sincerely yours,



Harold A. Beatty

HAB:AMC

Related Tests:

No. _____

Table _____

Test No. 38M-2505

Test Location DETROIT-SAN BERNARDINO

Equipment VARIOUS VEHICLES AND ENGINES

LEAD IN

CRANKCASE OIL Test Summary

ETHYL GASOLINE CORPORATION

Engineering Laboratory

Date Test Started JULY 7, 1938

Date Test Ended STUDY STILL IN PROGRESS

See Final Report No. _____

A. PURPOSE: TO DETERMINE THE QUANTITY OF LEAD COMPOUNDS WHICH COLLECTS IN THE CRANKCASE OILS OF PASSENGER CAR, TRUCK, AND TRACTOR ENGINES DURING ROAD AND DYNAMOMETER OPERATION.

B. TEST CONDITIONS AND PROCEDURE:DYNAMOMETER TESTS

LOAD AND SPEED: IN SOME TESTS CONSTANT, IN OTHERS VARIED.

DURATION OF TESTS: 56 TO 500 HOURS.

OIL ADDITIONS AND CHANGES: IN THE 56-HOUR TESTS, MAKE-UP OIL WAS ADDED AS NEEDED. ONE DRAIN AT END OF EACH TEST; DRAININGS RETAINED AND ANALYZED. IN THE 500-HOUR TESTS ON TRACTOR ENGINES, MAKE-UP OIL WAS ADDED AS NEEDED. OIL CHANGES AT 40 TO 64-HOUR INTERVALS; DRAININGS RETAINED AND ANALYZED.

ROAD TESTS

TYPE OF SERVICE: MILD CITY AND SEVERE CROSS-COUNTRY.

OIL ADDITIONS AND CHANGES: MAKE-UP OIL ADDED AS REQUIRED. OIL CHANGES AT 2000 MILE AND LONGER INTERVALS FOR COMPANY-OWNED AND PRIVATE CARS RESPECTIVELY; DRAININGS RETAINED AND ANALYZED.

OIL DRAINING PROCEDURE: OIL DRAINED; OIL PAN REMOVED, SLUDGE SCRAPED FROM PAN AND CRANKCASE AND PLACED IN SEPARATE CONTAINER. LEAD DETERMINATIONS MADE SEPARATELY ON DRAININGS AND SLUDGE AND LEAD CONTENT AT EACH DRAINING DETERMINED BY THE ADDITION OF THE TWO.

C. SUMMARY OF TEST MATERIALS AND RESULTS:

		FUEL			OIL			LEAD CONTENT, BY WEIGHT	
ENGINE OR CAR	YEAR	BRAND	COMPANY	CC.PBET ₄ PER GAL.	BRAND	SAE NO.	NO. OF SAMPLES	RANGE	AVG.
(DYNAMOMETER TESTS)									
INTERNATIONAL*	F-20	SOHIO X-70	STD.OHIO	2	POLARINE	30	11	.24- .30	0.28
CHEVROLET	1939	RED CROWN	STD.IND.	3	(5 BRANDS)	30	8	.55- .84	0.70
CHEVROLET	1938	RED CROWN	STD.IND.	3	(3 BRANDS)	30	4	.79-1.10	1.00
PLYMOUTH	1939	RED CROWN	STD.IND.	3	SINCLAIR	30	1	-	0.87
									AVG. 0.71
(ROAD TESTS)									
OLDSMOBILE 6	1936	VARIOUS	VARIOUS	3	STAROLINE	20-30	8	.42-1.18	0.93
PONTIAC	1938	RED CROWN	STD.IND.	3	STAROLINE	20-30	4	.49-1.41	1.00
BUICK 60	1938	VARIOUS	VARIOUS	3	VARIOUS	20-30	5	.41- .77	0.53
OLDSMOBILE 8	1937	VARIOUS ETHYLS		2.5+	VARIOUS	20	3	1.16-1.54	1.32
PONTIAC 8	1937	TEXACO ETHYLS		2.5+	HAVOLINE	20	4	.75-2.49	1.66
OLDSMOBILE 6	1937	VARIOUS ETHYLS		2.5+	HAVOLINE	20	3	1.07-1.69	1.25
G.M. TRUCK	1935	"FLASH", RICHFIELD		3	ZEROLENE	40	11	.30- .97	0.61
OLDSMOBILE 8	1937	"FLASH", RICHFIELD		2	ZEROLENE	30	12	.34-1.24	0.81
BUICK 40	1937	"FLASH", RICHFIELD		3	ZEROLENE	30	9	.38-1.12	0.81
BUICK 40	1939	"FLASH", RICHFIELD		3	ZEROLENE	20	3	.27- .44	0.33
BUICK 40	1939	"FLASH", RICHFIELD		3	ZEROLENE	30	1	-	0.44
BUICK 40	1939	"FLASH", RICHFIELD		3	ESSO NO. 1	-	1	-	0.25

* TRACTOR

AVG. 0.82

D. CONCLUSIONS: THE LEAD CONTENT OF OILS OBTAINED FROM DYNAMOMETER TESTS RANGES FROM 0.24% TO 1.10% BY WEIGHT OR FROM 0.040% TO 0.18% BY VOLUME. THE LEAD CONTENT OF OILS OBTAINED FROM ROAD TESTS RANGES FROM 0.27 TO 2.49% BY WEIGHT OR FROM 0.045% TO 0.42% BY VOLUME. THE AVERAGE LEAD CONTENT OF OILS OBTAINED FROM BOTH TYPES OF TESTS IS 0.803% BY WEIGHT OR 0.136% BY VOLUME. THE CHEMICAL RESEARCH LABORATORY AFTER MAKING ANALYSES ON NUMEROUS USED ENGINE CRANKCASE OIL SAMPLES DETERMINED A RATIO OF 0.17 TO 1 AS AN AVERAGE FOR THE RELATION BETWEEN % BY VOLUME OF LEAD COMPOUNDS TO % BY WEIGHT OF LEAD.

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Report By

Homer H. Dedo

Date

DECEMBER 18, 1939

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