ETHYL CORPORATION
RESEARCH AND ENGINEERING DEPARTMENT
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Cincinnati, Ohio

Dear Bob:

Herewith a rough draft of a possible statement for Jim Boudreau, some background information and beginning on page 10 some definite statements about lead. This is probably going to need considerable revision. I shall be glad to discuss it with you at your convenience.

Sincerely,

H. A. Beatty

HAB: cs
Enc.

Draft

The Relation of Automotive Vehicles to the Subject of Air Pollution

The Problem

Claims that automotive engines cause air pollution are by no means new to the industry. For many years, designers have recognized two problems: (1) carbon monoxide, and (2) objectionable smoke and odor.

The carbon monoxide is not a product of faulty design or operation. Rather, it is an inherent product of gasoline engine combustion. There is as yet no practicable way of eliminating it from the engine exhaust gas. Fortunately, a reasonable amount of ventilation is all that is needed to reduce the concentration in the open air to a safe level.

Smoke and odor may be harmless, but are certainly offensive in crowded traffic. Much progress has already been made in reducing the emissions, by way of good engine design and fuel quality. Today, such nuisance as exists is largely due to individual vehicles

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which are in need of maintenance.*

Now, a third problem has arisen. It is the possible relation of exhaust gas to smog formation. Smog is a particular type of air pollution, which occurs frequently in Los Angeles and occasionally in other cities. It is not the same as ordinary fog or smoke. It is characterized by four different effects: reduced visibility, eye irritation, plant damage, and rubber cracking. The economic losses from smog are mostly indirect and difficult to calculate, but they are at least millions of dollars per year. No ill effects of smog on general health have been demonstrated, but it ~~is certainly~~ may be a major annoyance to ~~the~~ people in ~~the~~ one afflicted area.

Smog occurs only under certain conditions. These include: (1) a large mass of stagnant air; (2) man-made pollutants in large amount; (3) sunshine. The active materials present in smog have not yet been identified. One of them is believed to be ozone. Based on experiments, it is strongly suspected that the active materials are formed from a reaction or combination of certain hydrocarbon vapors with oxides of nitrogen, air, and sunlight. Just which hydrocarbon

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compounds are reactive is not yet definitely established.

Now, it is known that automotive engines do emit some quantities of hydrocarbons and oxides of nitrogen, as well as smelly oxidation products and smoke. Additional hydrocarbon comes from crankcase ventilation and from displacement of vapor in the fuel tank. For gasoline-powered vehicles, the total emission of hydrocarbon is surprisingly large - - as much as 5 to 10% of the fuel supplied. And the Los Angeles area uses nearly 5 millions of gasoline per day!

It is by no means certain that these hydrocarbons in exhaust gas etc. are the kind that form smog, but it seems quite possible that they are.

The amount of oxides of nitrogen in exhaust gas is small and varies widely with the conditions of operation. The total quantity emitted may well prove to be significant.

Finally, it must be recognized that in Los Angeles smog did not become a serious problem until about 1945. It would appear

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that the city's extraordinary increase in population and vehicular traffic was the factor most likely to be responsible for the change.

Although, these various facts and surmises have pointed the finger of suspicion toward the automotive vehicle as a possible major source of smog. This does not overlook other possible major sources, notably incinerators and various industrial operations. All possibilities will be considered as problems until the facts are known for sure.

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Agencies at Work

Study of air pollution in general has by no means been left to individual communities and industries. For many years, national agencies of high caliber have worked on this problem. These agencies include the U. S. Public Health Service, the Air Pollution Control Association, the Industrial Hygiene Foundation, etc. Special areas have been studied by the Military Services, the Atomic Energy Commission, the Manufacturing Chemists Association, the American Chemical Society, etc. Altogether, a lot of research and development money has been spent, and a great deal of information has been obtained and put to good use.

It has been estimated that about $100 million a year is spent in this country to combat air pollution. Most of this goes into industrial equipment, designed to prevent pollution at the source. Somewhere around $5 million a year is spent for research, enforcement, and administration.

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The Los Angeles smog problem has had special attention since 1947. In that year, the Los Angeles County Air Pollution Control District was organized under the County's Board of Supervisors by a State Act. Under the direction of Mr. Gordon P. Larson, the District has accomplished a great deal in the way of research, control, and public relations. It currently spends about $750,000 a year for this work.

Oil companies constitute a major industry in the Los Angeles area, and were perforce regarded as a potential source of pollution. In 1948 the Western Oil and Gas Association initiated an independent program of research on the subject. This was taken up in 1951 by the American Petroleum Institute. So far, they have spent over $1.5 million, mostly at Stanford Research Institute, on the cause of smog formation. Currently, the API Smoke and Fumes Committee is spending at the rate of $240,000 per year on research projects at eight different research institutions and universities. Mr. W. L. Stewart, Jr., is chairman of this activity and Mr. Vance L. Jenkins is executive secretary.

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The oil companies in the area have also invested $17 million in refinery equipment to reduce the emission of hydrocarbon vapors into the air during manufacture and storage of their products.

The Automobile Manufactureres' Association has set up a Vehicle Combustion Products Subcommittee, with Mr. John M. Campbell as chairman, to investigate the effects of automotive exhaust. In view of the mutual interest of the automotive and oil companies, the Coordinating Research Council recently organized a Group on Composition of Exhaust Gases. This group* comprises experts from 20 representative institutions, including oil, automotive, chemical, and other campanies and the U. S. Bureau of Mines. They will carry out extensive experimental work in their various laboratories.

Various other agencies, such as the U. S. Public Health Service, are at work onprojects related directly or indirectly to the study of smog.

* listed in Appendix No. 1

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Finally, there is the Southern California Air Pollution Foundation, established by a group of leading citizens as a non-profit, independent organization to coordinate various agencies in combating smog. It is directed by Dr. Lauren B. Hitchcock, and one of the trustees* is Mr. C. F. Kettering. The Foundations plans for a budget of $1 million a year. They propose to assemble and study all available information, and to farm out projects to suitable institutions where it appears that additional information is needed.

*listed in Appendix No. 2

Ethyl Corporation's General Interest

The Company has always taken an interest in any technical matters which are of mutual concern to the oil and automotive industries. That is so regardless of whether or not our products are involved.

Our experience in air pollution in this area goes back 20 years, in cooperative work on problems involving the emission of smoke and odor in the exhaust from certain vehicles.

At present we are contributing our technical experience through various channels. The most important are our memberships in an API Smoke and Fumes Project Advisory Committee and/in the CRC Group on Exhaust Gas Composition.

Lead in Exhaust Gas and in Air

The possibility of air pollution from the use of tetraethyllead in gasoline was investigated over 30 years ago.

In 1923, the U. S. Bureau of Mines undertook to study (among other things) automobile exhaust gases from leaded gasoline. They said: "Is there enough lead in the exhaust to create a hazard to the public in addition to the existing hazard of carbon monoxide (CO) in such gases?" Work was done by Dr. R. R. Sayers and others, with expert consultants; Dr. Sayers was Chief surgeon of the Bureau and a surgeon of the U. S. Public Health Service. A variety of animals were exposed for over a year to exhaust gas containing far more lead than normal. The results clearly showed that any hazard from lead in exhaust gas is negligible compared with that of carbon monoxide.

Further studies were made by government authorities in the United States, Great Britian, and France. Analyses were made for

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carbon monoxide and lead in the air under the worst conditions. Garage workers etc. were carefully examined. The conclusions were definite: (1) carbon monoxide is far more hazardous than lead, in automotive exhaust gas; (2) except in a closed space, normal dilution with air lowers the carbon monoxide content to well below dangerous levels.

Further investigations along these lines have been continued, to keep up to date and extend the range of knowledge. Chief among these is a continuous program at the Kettering Laboratory of the University of Cincinnati, under the direction of Dr. R. A. Kehoe. The subsequent findings have shown no reason to alter the original conclusions regarding lead in exhaust gas.

Why then are some people still concerned about the health hazard from this source? The answer is easy to see. They argue that lead is poisonous, automobiles discharge so much lead into the air, therefore the automobiles are poisoning the air. This is typical of the confused and fallacious reasoning that comes from not

understanding the technical facts of the matter. Such reasoning does no one any good, and it can stir up a lot of trouble.

Actually, lead in small enough quantities is not poisonous. There is lead in all the food we eat and water we drink, as well as in all the air we breathe. The average city-dweller takes in daily about 30 times as much lead from his food and drink as from the air he breathes. He doesn't accumulate this lead permanently in his body, but excretes it and so keeps in balance. His system can comfortably accomodate a daily intake considerably larger than the normal one.

As for the air we breathe, there is lead in it everywhere. There is more in urban than in rural air, and more in industrial than in residential districts, but the differences are not great. The amounts are small: for industrial cities, the average is generally from 1 to 3 micrograms per cubic meter. Occasionally, as in severe smog, the level may rise as high as 20 to 40.

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This is still well below the level considered perfectly safe for prolonged exposure, which is 150.

This lead in the air comes from a wide variety of sources, some natural and some man-made. Burning of coal and refuse, weathering of paint, industrial operations involving lead*, dust storms, etc. are among these sources. What part of the total is contributed by automobile exhaust is not yet definitely known.

It is known, however, that only a part of the lead in gasoline is converted into air-borne dust. Some of it remains behind as deposits in the engine and exhaust system and some is carried away in the crankcase oil. The amount which remains behind varies widely, depending the history of the engine and the exhaust system and on the conditions of operation. For this reason, no exact figures are available.

The rest of the lead must come out with the exhaust gas. It is known that a major part of this lead is expelled at intervals,

* cf. Appendix No. 3

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in the form of large particles of various inorganic lead compounds. By large, we mean 5 microns (2 ten-thousandths inch) or more in diameter. Such particles cannot remain airborne, but must fall to the ground in a few seconds or minutes time.

The smaller particles of these lead compounds may remain airborne for a time. At most, their concentration is of the order of micrograms per cubic meter, because of the immediate dilation of the exhaust gas with air. At this level, it is generally believed that the particles make no appreciable contribution to either smoke or smog.

There is no expectation of finding any detectable amount of tetraethyllead or other organic lead compounds in the exhaust gas.

The chlorine and bromine compounds present in antiknock fluid are likewise too small in amount to be of significance in the air pollution picture. For example, the amounts of chlorine compounds commonly found in city air are far greater than could be accounted for by automobile exhaust gas.

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There is as yet no information on the phosphorus compounds inn exhaust gas. Again, however, it is clear that the amount is too small to be of likely significance.

The research laboratories of Ethyl Corporation have for some years been studying the subject of lead in exhaust gas. Experimentally, the work is not easy because of the small quantities and irregular outputs involved. However, some reliable results have been obtained, and the work is being continued. The results will be made available to anyone having a legitimate technical concern with the subject. That means specifically the Southern California Air Pollution Foundation and the CRC Group on Exhaust Gas Composition, as well as the Kettering Laboratory.

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