

ETHYL CORPORATION

Inter-Office
Correspondence

To: Dr. W. B. Ligett Address: Detroit
From: Dr. A. S. Hawkes Address: Detroit
Subject: Discussion with Dr. R. A. Kehoe Date: September 19, 1957
(September 18, 1957)

The following is a summary of discussions held here yesterday between Dr. Kehoe and interested personnel.

1. Separation of lead particles from exhaust.

Mr. Hirschler outlined the status and results of his study of filtration and separation of lead particles from engine exhaust streams. It was agreed that the study should be continued to provide data using a larger filter and using a combination of the larger filter preceded by a nail pot. Dr. Kehoe urged the publication of data based on a final report of activity in this program. Such publication insures the presentation of reliable data and shows that we are active in a controversial field. The data may also be helpful to those working on catalytic mufflers, and may stimulate new approaches to the exhaust pollution problem.

2. Lead in Air-Kettering Lab Work.

Dr. Kehoe outlined some of the studies in the Kettering Labs on the long-term exposure to air-borne lead oxide by laboratory personnel. Individuals have been exposed for 7.5 hours a day, five days a week in test chambers, for periods exceeding a year, to air-borne PbO at lead concentrations up to 75-100 micrograms per cubic meter without ill effect. The studies have shown that particles of substantially less than one micron are very extensively (i.e. ca 35-50%) trapped in the lung alveoli where the lead is efficiently and rapidly assimilated. Above one micron, the particles can be trapped in the upper respiratory tract (up to 80% efficiency) and subsequently swallowed. The studies may be extended to include inorganic lead in forms other than PbO.

The allowable lead content in air (for industrial standards) has recently been raised from 150 to 200 micrograms per cubic meter. The maximum allowable in Ethyl's manufacturing area is 75 $\mu\text{g./cu. m.}$, and the "normal" in high exposure areas is about half this concentration. The "normal" lead content in human blood is 0.03 mg lead/100 g. blood; a content of 0.08 mg/100 g. indicates severe exposure where toxic effects will be noted.

Dr. Kehoe estimated that the odor of TEL would normally be detected at concentrations of 1-2 ppm.

3. Effect of manganese or lead particles in exhaust.

It was agreed that we need data as soon as possible on the effect of manganese fuel additives on the nature of exhaust solids. Engine tests will be

run to determine the composition and size distribution of exhaust solids, with fuels containing AP-3 with and without TEL. It was agreed that initially, at least, fairly high manganese contents would be used to establish gross effects. Detroit personnel will decide other fuel factors, such as scavenger, phosphorus, sulfur content, etc., based on speculated future use. Based on data so determined, Dr. Kehoe will initiate toxicological studies of the effects of exhaust solids on animals.

4. Smog experiments at Midwest.

Dr. Kehoe agreed that further study was not warranted now, but that the study might be reactivated only to answer the need for specific data in the future.

5. Effect of manganese on SO_2 - SO_3 reaction.

Dr. Rifkin outlined our recent interest in work of Johnstone of Illinois on the effect of manganese on the conversion in the atmosphere of SO_2 to SO_3 with ultimate conversion to droplets of sulfuric acid. Johnstone has referred to the effect of H_2SO_4 mists in disasters in London, Donora, and the Meuse areas. Haagen-Smit of Cal. Tech. has stated that SO_2 cannot be detected in the L.A. area by ordinary analytical methods.

Although H_2SO_4 droplets in the atmosphere do not represent a "happy situation", Dr. Kehoe does not feel such a condition is a general problem. He pointed out that there is not considered to be much difference in the toxicity of SO_2 and SO_3 . It is generally accepted as "fact" that the mucous membranes instantaneously convert SO_2 to SO_3 , although Dr. Kehoe is not aware of how this has been (or could be) proved. The effect of manganese on the SO_2/SO_3 ratio in engine exhausts will be investigated briefly by Dr. Rifkin.

6. Toxicity of AP-3 and AP-30

Dr. Kehoe stated that we should maintain the working principle that AP-3 has the same order of toxicity as has TEL. He has no data yet on the "chronic" toxicity of AP-3, but AP-3 is absorbed by the body by the same avenues as is TEL. He presented some LD_{50} data, which supported these relationships. A complete report of available data will be issued within a couple of weeks.

There are no data yet on the accumulative effect of AP-3, or its distribution in body tissues. It is not yet known whether the pathological results are attributable to manganese per se or to AP-3. Dr. Kehoe pointed out that manganese toxicological data are meager, and previous industrial experience is based on mining and milling operations.

Dr. Kehoe was informed of our possible increased interest in AP-30 because of the hydrocarbon supply situation. He will take this into account in his studies.

7. APR-6 as a cutting fluid.

Mr. Chalk informed Dr. Kehoe that we had no immediate needs for further help on APR-6 toxicity to permit the evaluation of APR-6 as a cutting fluid additive. Should commercial prospects for this application appear later, Dr. Kehoe will be so informed, and further studies or recommendations may be indicated.

8. Organometallics as wear additives in oils.

Dr. Kehoe offered to send us an old report on the toxicity of TEL in lube oil solvents. These data would serve as a guide as to whether this and other organometallics could be reasonably acceptable in such applications. If not, we should reconsider our research efforts in this direction.

9. Toxicity of AN compounds.

Dr. Kehoe provided toxicity data for a series of AN compounds, taken from a forthcoming report. He also dictated a toxicity statement for these compounds to be used in brochures. This statement has been already forwarded to those concerned.

10. Work on use of aluminum alkyls.

Dr. Kehoe recognizes that the toxicity of TEA and TMA in concentrated form need not be of concern, because of their spontaneous flammability. He does have some apprehensions on two other counts, however: (a) Are we taking all due precautions against fire hazard in the storage and handling of these compounds? Do we have adequate regulations as to containers (type and size), personnel protection equipment, amount of laboratory storage, designated storage areas, etc.? (b) Should Ethyl accept the responsibility for providing toxicity information for solutions of these alkyls where spontaneous flammability is not a problem? Dr. Kehoe feels that if we or our customers use such solutions in future operations, probably we, as suppliers, should be obtaining toxicity information. He would like a statement of policy and recommendations from responsible persons (Drs. Beatty and Neher).

11. Absorption of TEL by Gunitite liners.

Dr. Kehoe has a request from Humble for information regarding the absorption of TEL from gasoline stored in Gunitite-lined tanks (lined on sides and top, but not on bottom). The request asks for advice regarding hazards and precautions to be used during entry of such tanks for maintenance and repair, including welding.

Dr. Kehoe should be advised of any data we have in Detroit.

12. Toxicity of phosphorus compounds.

Dr. Kehoe advised continued precautions in the preparation and handling of all phosphorus compounds, especially in exploratory research. The toxicity of such compounds varies widely with structure and cannot be reliably anticipated in new compounds.


A. S. Hawkes

ASH/btm

Distribution:	H. A. Beatty	R. V. Kerley	F. J. Schroeter
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	R. D. Closson	W. G. Lovell	R. Sugimoto
	E. G. DeWitt	C. M. Neher	T. S. Taylor
	H. J. Gibson	E. B. Rifkin	P. E. Weiner
	✓ R. A. Kehoe	R. K. Scales	H. E. Hesselberg

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ETHYL CORPORATION

INTER-OFFICE

TO	Mr. R. K. Scales	ADDRESS	Detroit
FROM	W. G. Lovell	ADDRESS	Detroit
SUBJECT	Discussions with Dr. R. A. Kehoe	DATE	September 4, 1957

Some of the subjects that might be discussed with Dr. Kehoe on his proposed visit to Detroit about September 18 include:

Filtration or separation of lead particles from exhaust
 Effect of manganese on lead particles in exhaust
 Manganese particles in exhaust
 Experiments on lead absorption at Cincinnati
 Toxicity of AP-3 and AP-30
 Johnstone paper on SO₂ atmospheric pollution
 APR-6 as cutting fluid
 Effect of manganese on SO₂-SO₃ reaction
 Smog experiments at Midwest
 Work on use of aluminum alkyls
 Toxicity of AN series of phenols

D. A. Hirschler
 D. A. Hirschler
 D. A. Hirschler

~~R. D. Closson~~ *as Hawkes*
 E. B. Rifkin
 H. Chalk
 E. B. Rifkin
 H. E. Hesselberg
 H. A. Beatty
~~E. G. DeWitt~~
Beatty

The names after the subjects indicate the men here who may wish to participate in the discussion.


 W. G. Lovell

WGL:deb

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H. A. Beatty
 H. Chalk
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