ETHYL CORPORATION

November 25, 1964

Memorandum to:

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Gentlemen:

The preparation of the so-called White Paper entails as a primary step the determination of outline.

I am attaching for your information and comments our first draft of the outline upon which the basic White Paper will be prepared.

The appearance of certain items in this outline does not necessarily mean that they would be included in the final paper. Our first concern, however, is to cover the waterfront and include anything and everything which could create a favorable position for the company.

As you know, the time element is very important in this program, and I would therefore greatly appreciate your prompt consideration of the outline.

Sincerely,

James E. Boudreau

JEB:w
Attch.

November 24, 1964

Outline - Antiknock Compounds

1. Introduction
   a. Definition of antiknocks.
   b. Kettering-Midgley-Boyd research work.
   c. Midgley's two basic discoveries---(1) inherent tendency of gasoline to knock, (2) antiknock properties of TEL.
2. Commercialization of tetraethyl lead
   a. Formation of Ethyl.
   b. Du Pont's role in the development.
   c. Du Pont and Ethyl competitors since 1948.
   d. Houston Chemical and Nalco.
   e. Leading foreign producers.
3. Manufacture and Use
   a. How manufactured.
   b. How used in a refinery.
   c. Initially introduced in premium gasoline.
   d. Introduced in regular gasoline in the 1930's.
   e. Use in aviation gasoline.
   f. Today used in 98% of all U.S. gasoline and in most foreign gasolines.
   g. Standardized handling procedures.
   h. Price stewardship.
4. Value of TEL to vehicle performance
   a. Adds octane numbers - range - average.
   b. Adds Motor numbers - value over reforming.
   c. Improves road performance.

5. Long-Term contributions to automotive progress

   a. More efficient utilization of gasoline.

   b. Higher octane gasoline made possible more efficient engines.

   c. Increase seen both in power and gasoline mileage and in value of each gallon of gasoline.

   d. Ton-mile story.

6. Importance to the oil industry

   a. Led to more uniform gasoline quality nationwide.

   b. Led to establishment of two-grade gasoline system which enabled the oil industry to meet higher octane requirements step by step.

   c. Improved gasoline quality simply and economically.

   d. Savings in capital investment over the years.

   e. Conservation of oil resources over past 25 years.

7. Importance to the oil industry today

   a. TEL is a refinery tool. Used in economic balance with processing. Relative octane costs of TEL versus processing.

   b. Adds flexibility to refinery operations. Balances demand between premium and regular gasoline and between gasoline and other products. Helps refiners to adjust to seasonal fluctuations in product demand.

   c. Assists in industry's long-range planning by helping refiners to space capital investments in new equipment.

   d. TEL is of particular importance to small refiners.

   e. Added value in a national emergency.

8. Evolution of antiknock compounds.

   a. TEL.

   b. Scavengers - changes in fluid composition.

   c. Other additives - iron carbonyl, manganese, nickel compound.

   d. TEL-TML mixtures. Early development. Reasons for them today.

   e. TEL still best all-around antiknock in use.

9. Some antiknock research contributions

   a. Bromine - led to recovery of magnesium from sea water.

   b. Octane scale - set a standard and led to uniformity of gasoline quality.

   c. Early work on hydrocarbon composition.

   d. Farm tractors.

10. Antiknocks and national defense.

   a. 87 octane gasoline.

   b. 100 octane gasoline.

   c. World War II - Battle of Britain - quote British Minister of Production.

   d. No shortage of TEL during World War II for essential needs---because of installed capacity.

   e. Maintenance of civilian gasoline quality during World War II.

   f. Allocation of TEL during Korean War (stewardship).

11. Broad aspects of Ethyl research

   a. Liaison between oil and automotive industries.

   b. Understand whole fuel-engine environment and importance of product compatibility.

c. Work on other additives-(1) amyl nitrate, (2) CI 2 - home heating oils, reduced smoke, (3) Phosphorus compounds, (4) MPA, (5) Antioxidants - orthoalkylation, (6) Monopropellants (normal propyl nitrate and mixed ethyl-propyl nitrate), (7) Aluminum alkyls.

d. Imaginative organization - location of laboratories - number of patents.

e. Government contract research work.

f. Assistance on sodium heat-exchange mechanisms for atomic reactors.

12. Use pattern of antiknocks

a. 3 milliliters original limit in automotive gasoline - USPHS Surgeon General's report.

b. Increased to 4 milliliters in 1958.

c. Concentrations in aviation gasoline as high as 6 mls in World War II, 4.6 mls now.

d. Advent of jet fuels - decline of avgas.

e. Present average concentrations in premium and regular gasoline. Pool average. Equivalent to less than a teaspoonful per gallon of gasoline.

13. Mechanism of antiknock action

a. How TEL works.

b. Effect of lead on engine parts - spark plugs, valves, mufflers.

c. Development of scavengers and improved fluid compositions.

d. Improved engine parts - sodium cooled valves, improved valve steels, valve rotators, spark plugs, changed combustion chamber design. Valve life now warranted for 50,000 miles by Chrysler.

14. Toxicity of antiknock compounds

a. Highly toxic in concentrated form.

b. Elaborate system of controls for manufacturing, distribution and handling.

c. Field ~~safety~~ work - mixing plant inspections - tank cleaning - lead-in-air analyzer - medical examinations.

d. No fatalities in field when our safety regulations were observed.

e. Three refinery safety films - (broad interest of Ethyl in safety).

15. Public responsibility of Ethyl

a. Voluntary withdrawal from market in 1925.

b. PHS investigation.

c. Self regulation - standards - ~~safety procedures~~ - maximum use limits.

d. Work by Kettering lab - broad review. Recent Kehoe statement.

e. TEL most comprehensively studied industrial chemical.

f. Success with TEL encouraged other companies to introduce other new products and establish their toxicological limits.

g. Dr. Luther Terry quote at dedication of Kehoe wing of Kettering lab - see April 1964 Ethyl Reporter, first and last pages.

16. Relationship to air pollution, ~~and smog~~.

a. Variables of air pollution - location, altitude, time of day.

b. Industrial versus community air standards.

c. Mechanism of lead in auto exhaust system. Hirschler paper.

d. Discharge into atmosphere - nature of ~~lead particles~~ particulate lead compounds.

e. True level of discharge after allowing for percentage remaining in cars.

f. Other sources of lead in atmosphere.

g. Patterson studies of lead in ocean and in glaciers have no bearing on problem. Criterion is amount of air-borne lead to which population is exposed.

h. Metabolism in human body. No significant accumulation under normal (present) environmental conditions.

i. Other materials inhaled or consumed.

j. TEL and major illnesses.

k - Surveys of urban atmosphere by Kettering Laboratory, sponsored by Ethyl Corporation, from 1960

k. Three city survey 1961-64

M. Artificial Simulation of photochemical pollution of ambient atmosphere ~~Smog chamber studies~~ - Midwest Research Institute.

17. Auto exhaust

a. Composition of exhaust - pollutants - see Kettering symposium paper.

b. Role of TEL.

c. Effect of TEL on <u>volume</u> of emissions.

18. Catalytic mufflers

a. Problem with early mufflers.

b. Ethyl's device.

c. Present status of muffler program.

19. Modified engines

a. Chrysler - GM - Ford.

b. Other manufacturers.

c. "Ethyl" engine.

20 - Blowby control devices

a. Value in reducing emissions.

b. Importance of proper servicing.

c. Ethyl film.

21. Importance of tune-ups in reducing air pollution (see Scott study)

    a. Effects of engine maladjustments.

    b. Benefits of regular tune-ups.

22. Ethyl cooperation with ~~government~~ public agencies

    a. U.S. Public Health Service.

    b. California authorities.

    c. Air Pollution Control Association.

    d. Other groups (MCA, API, AMA).

    e. Kettering lead symposium.

23. Aid to Education

    a. 300 fellowships. Cumulative expenditures. Support of graduate education in Occupational and Environmental Medicine and Hygiene

    b. Sponsor fundamental research work.

24. Community citizenship

    a. Work with community groups - gave over $250,000 to two hospitals in Baton Rouge - United Fund, Symphony, Boy Scouts, Junior Achievements - Employees who are public officials.

    b. 25 years in Baton Rouge - Chamber of Commerce testimonial dinner.

25. Effects of restrictions on TEL use.

a. Any restrictions would cause great harm.

b. If TEL removed entirely, with no compensating changes in processing, gasoline quality would return to the levels of 1953.

c. Motorists would need to consume 10% more gasoline to meet present-day requirements.

d. Costs would increase - anywhere from 2¢ to 10¢ a gallon.

e. Crude oil would be wasted.

f. Small refiners would be severely hurt.

g. A safety factor in time of national emergency would be lost.

h. Changed composition of gasoline could bring new air pollution problems (aromatics).

26. Changing nature of the air pollution problem

a. Air pollution a problem of our industrial civilization. We can't have our cake and eat it too. If we had perfectly clean air, we would have to do without a lot of modern conveniences.

b. Constantly changing nature of our air pollution problem due to changing environment. Decrease in lead concentrations in Cincinnati (despite increasing automobile population) due to declining use of coal. Changing fuel-engine environment makes for further changes.

c. Lead no problem at present atmospheric levels and is unlikely to be one in the foreseeable future.