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Feb. 18, 1952.

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February 1, 1952

Dr. Robert A. Kehoe, Director
Kettering Laboratory
University of Cincinnati Medical School
Cincinnati 19, Ohio

Dear Dr. Kehoe:

I enclose a copy of my write-up of my conference with you last week. If you find any serious errors in it, I wish you would let me know. I have asked Bill Carlisle at Standard Oil Company to try to locate and send me copies of any copies they may have of the reports of the Medical Committee (Dr. Thompson, Dr. Smith and yourself). If they are unable to locate them, I may be obliged to ask you to request your secretary to make me a copy of the report signed by Dr. Gilman Thompson, which you showed me when I first entered your office.

I was glad to send you some Bell & Bates coffee yesterday, and I hope it tickles your palate.

Sincerely yours,

James D. Carpenter
James D. Carpenter

JDC:JD

Enc.

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UNITED STATES v. duPONT, GENERAL MOTORS, et al.

Memorandum of Conference

with

DR. ROBERT A. KEHOE

Director of Kettering Laboratory of Applied Physiology,
University of Cincinnati

and

Medical Director of Ethyl Corporation, 1924-1952

January 24, 1952

* * *

Dr. Kehoe became Medical Consultant for General Motors ^{Chemical Company} ~~Research Corporation~~ about June 1, 1924. Midgley met him at a ^{lead} ~~various~~ Chemical Society meeting sometime before that, at ^{one of} which Dr. Kehoe had read a paper on lead poisoning. He ^{became} was a member of the Medical Committee that was appointed ^{to investigate the status of the hygienic problems associated with the use of TEL, for the group of industries concerned.} ~~at the suggestion of~~ ~~Mr. Sloan, in April, 1924.~~ Dr. Gilman Thompson, Medical Director of the Standard Oil Company, and Dr. Smith, Medical Director of the duPont Company, were the other members of this Committee. The first report of the Committee was presented August 20, 1924; Dr. Kehoe does not have a copy of it. He has a copy of Progress Report No. VI upon the medical aspects of tetra-ethyl-lead poisoning, dated April 1, 1925 and signed only by Dr. Gilman Thompson. This report says that there were poisonings of all degrees, as follows:

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Bayway	71
Deepwater	?
Dayton	49

It reports that there were deaths as follows:

Bayway	5
Deepwater	6
Dayton	2

Dr. Kehoe says that the reason the number of poisonings of all degrees at Deepwater was not stated, was because at that time the duPont Company kept no formal records or reports from which this information was obtainable; that while the duPont Company had a Medical Department at that time, its records were so cursory and inadequate that an examination of them did not reveal anything of value. He also said that Mr. W. F. Harrington of the duPont Company asked him to make recommendations as to what the duPont Company should do to set up a first class Medical Department; that he told Mr. Harrington that the first step was to select a competent Medical Director and provide him with proper medical headquarters, and place him in absolute control of the medical aspects of the business. As a result of this conference, the duPont Company some months later followed his advice, appointed a competent Medical Director of their own choice, from and after which date the Medical Department was properly run. He says that he was retained as a consultant by the duPont Company for many years, and assisted the Medical Director to set up his department.

Dr. Kehoe has no records of tetra-ethyl-lead poisonings

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at the small plant of American Research Laboratories, Inc., in or near Denver, in 1926. In 1941 a different outfit made tetra-ethyl-lead at Denver, and his assistant, Dr. Willard F. Machle, made an examination and report of the Denver operation. Everybody there suffered tetra-ethyl-lead poisoning, and the Denver authorities closed the operation down. A copy of Dr. Machle's report will be annexed to this memorandum. Dr. Machle is presently Executive Officer, Division of Medical Sciences of the National Research Council, 2101 Constitution Avenue, Washington 25, D. C. and lives at 816 S. E. 25th Avenue, Fort Lauderdale, Florida.

Dr. Kehoe has in his office records of every case of lead poisoning in this country that has been reported since June, 1924. He says that the reports of the hearings before the Surgeon General's Committee will show his testimony before that Committee, and that he took a prominent part in that whole investigation.

Dr. Kehoe gave me a copy of a paper entitled, "Tetra-Ethyl Lead Intoxication and Poisoning by Related Compounds of Lead", made by Dr. Machle and reprinted from the Journal of the American Medical Association, August 24, 1935, Vol. 105, pp. 578-585. On page 8 of this paper is a table which gives the incidence of poisoning in the various groups in the period from 1925 to 1930, and from 1930 to 1935. Accurate figures on the incidence of poisoning prior to 1925 are not available, according to the report. This table is as follows:

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	Number of Cases	
	1925 to 1930	1930 to 1935
Manufacturing operations, . . .	61	4
Tank cleaning	0	11
Accidental ingestion	0	2
Laboratory work.	0	0
Blending	0	0
Total . . .	61	17

In this paper, Dr. Machle says:

****Approximately 300 to 600 men are employed in the manufacture of the fluid or in maintenance operations on the equipment in the one plant where it is now being manufactured. These men are under careful medical supervision, and exceptional precautions are taken to prevent cutaneous contact or inhalation of vapor. As a consequence, only four incipient cases with no fatalities have developed since the institution of the present regimen in 1925. Another group of about 1,700 men is engaged from time to time in blending the tetra-ethyl lead-containing fluids into gasolines in various refineries in the United States. This group has been under the supervision of the medical department of the Ethyl Gasoline Corporation and has shown no cases of lead poisoning. In fact, recent studies by Kehoe have shown that the mean excretion of lead of these men is not significantly different from that of other men in industry not specifically exposed to lead. The latter group and in addition a variable number of employees in general refineries may at intervals of from one to two years be engaged for a few days in cleaning storage tanks that have contained gasolines to which lead has been added. While it is true that at the present time hygienic measures are in effect similar to those for the protection of the men engaged in the blending process and that there is no possibility of significant exposure provided the precautions are observed, the hazards are real and the safety of the men depends on constant vigilance. It may be expected, therefore, that exposure and illness will occur if the safety measures are improperly carried out or temporarily relaxed. After long standing in storage tanks, tetra-ethyl lead in commercial concentration in gasoline may undergo partial decomposition, with the formation of a variety of compounds, such as triethyl lead bromide or hydroxide and diethyl lead salts. These compounds are in general of low volatility but may be dispersed as fine dusts when the storage tanks are dried before being cleaned. In eleven of the cases under observation, exposure occurred during tank-cleaning operations of this sort. Aside from

evidences of irritation to the eyes and upper respiratory tract during the period of exposure, there were no differences in the apparent toxicologic action or clinical behavior in those cases as compared to others in which the exposure was to pure tetra-ethyl lead, tetra-ethyl lead mixed with ethylene dibromide, and other lead compounds.

"Another group of men of varying number who may be exposed from time to time are the chemists, laboratory workers and other investigators who prepare or handle small amounts of organic lead compounds for experimental use."

Dr. Kehoe says that in tank cleaning operations the fatalities increased progressively until 1940, and dropped sharply thereafter. There were ^{about} 100 cases with about twenty fatalities in the United States up to 1940. Since 1940 there have been, altogether, two cases, among employees of oil companies, with one fatality.

The Ethyl Corporation which, between August, 1924 and December 31, 1947, distributed all the tetra-ethyl-lead to refiners and jobbers in the country, set up, at Dr. Kehoe's suggestion, a Safety Department. This department has issued very strict rules and regulations for the handling of ethyl fluid, and as soon as trouble in tank cleaning developed, it issued strict rules and regulations to be followed in any and all tank cleaning operations. When these rules have been adhered to, and the tank cleaning has been done under the supervision of Ethyl Corporation's experts, there have been no cases of lead poisoning resulting therefrom. The instances of lead poisoning have all occurred when tank cleaning operations were done without notification to and supervision by Ethyl Corporation and its experts.

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Dr. Kehoe was asked whether, in his opinion, public good had resulted and the public health had been protected, by the care and supervision of the duPont Company and Ethyl Corporation. He said that the safety of the tetra-ethyl-lead industry depends upon two things:

1. The precision with which the fluid is mixed with gasoline, in quantities not to exceed a safe level. He said this cannot be controlled by legislation. It requires continuous hygienic and technical supervision.

2. The control of transportation. This determines and controls the safety of the carriers. Every part of the equipment, its design and construction, must be such as to make it as foolproof as possible. The manufacturer, he says, can control the manufacture of the material upon his own plant grounds. He cannot control what goes on after the material leaves his hands.

Ethyl Corporation, by the continuous taking of samples at gasoline dispensing pumps throughout the country, and the analysis of such samples at its own laboratories located in various sections of the country, knows precisely how much tetra-ethyl-lead is being used in all grades of gasoline. Dr. Kehoe says that no law can be passed that will control the concentration of lead in gasolines, and no law will prevent a refiner from using any quantity of lead in his gasolines that he wishes; that only by the systematic inspection of gasolines by the Ethyl Corporation, and its insistence that the rules and regulations of the Surgeon General be strictly complied with, have disasters of

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major importance been avoided. Tetra-ethyl-lead is shipped to refiners in specially built tank cars, in specially designed steel drums, and in special tank trucks.

not
true

The necessity for this, Dr. Kehoe says, is illustrated by experiences in Italy, where there are two manufacturers. One is Montecatini, the principal group, who are reasonably careful in their manufacturing operations, and who had the Associated Ethyl Company build them a modern blending plant. The other is "Sloi", a group who manufacture tetra-ethyl-lead at Ravenna in a shoestring operation, which is very carelessly operated. He says these people have continuing illnesses and fatalities because they are dealing with a government that has no effective regulation. The government is concerned with its national economic situation, and is exercising no care for the ~~public's~~ ^{of workers in the same situation} protection. The Sloi group is operating without conscience. The Montecatini people are more careful, but they are not prepared to concern themselves in any way as to what their customers do with the product. It is packed and shipped like any other bulk chemical. Dr. Kehoe says that some of the Italian tetra-ethyl-lead is shipped in good containers and some is shipped in ordinary tin containers, that it is handled carelessly in blending, with no effective or intelligent controls, and that the situation with regard to tetra-ethyl-lead in Italy is terrible.

The Poamol people in Spain made tetra-ethyl-lead, handled it very carelessly, shipped it in tin cans to filling stations, and it was dispensed as tetra-ethyl-lead was originally

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dispensed over here, at each bulk station. No records were kept, and no controls exercised. To get rid of this operation, ^{Ethyl E. J. Corp} (Associated) Ethyl bought it out and closed it down. So far as Dr. Kehoe knows, no tetra-ethyl-lead is being manufactured in Spain at this time.

He says that in Germany there were ^{three} two plants in operation at the time of the War. The Russians removed ^{two} one of these in toto to Russia, and took with them the personnel of ^{only} the plant, in toto, and Dr. Kehoe says that this operation should be all right. The other tetra-ethyl-lead plant in Germany was dismantled and moved to Russia, and he says that judging by what happened in Poland, the situation in Russia at this second lead plant must be very bad, for in Poland there were no suggestions of any control. The Russians manufactured some tetra-ethyl-lead before and during the War, and judging by what happened in Poland, no controls of any kind are anticipated. Dr. Kehoe gave me translations of two papers, one being "Nonoccupational Poisoning by Tetraethyl Lead" by E. N. Marchenko and G. A. Beilikhis, from the Chief State Sanitary Inspection Board, R.S.F.S.R. and State Sanitary Inspection Board, Moscow, 1946. This paper, after telling what tetra-ethyl-lead is, and what ethyl fluid is, describes the poisoning symptoms:

"Some cases of poisoning by TEL which have occurred, have been described by Russian clinicians: in the use of ethyl gasoline for illumination purposes, in the utilization of unguarded ethyl fluid railroad cars for transporting people and baggage, drinking spirits contaminated with TEL, using railroad cars, which have not been cleaned after carrying ethyl fluid, for transporting people, distillation of ethyl fluid for obtaining 'fuel'.

"In the course of the past few years we have accounted for and investigated the circumstances of 23 occurrences of group poisoning. Only in one occurrence was the number limited to one person; in 10, there were 5 victims; in 8, from 5 - 10; the greatest number of victims (49 persons) occurred in one

case. Usually the course of the poisonings was most severe, with high fatality (more than 30%).

"The most frequent infringements of the regulations governing commerce in ethyl fluid and ethyl petroleum products, as a result of which TEL poisoning was produced, were: 1- insufficient safeguarding of objects in which ethyl fluid or ethyl gasoline had been, or commodities contaminated by them; 2 - mixing ethyl fluid with fuels elsewhere than in mixing plants; 3 - infringement of regulations safeguarding ethyl fluid transportation by railroads, and prescribed cleaning of cars after transporting ethyl fluid.

"Table 1 illustrates the frequency of poisonings according to each of the outlined causes.

TABLE 1.

Cause of poisoning	Number	
	Occurrences of poisoning (in % to total number)	Victims
Insufficient safeguarding of containers with ethyl fluid	65.5	65
Mixing ethyl fluid with fuels elsewhere than in mixing plants	21.5	17
Violation of regulations governing railroad cars with ethyl fluid and cleaning the cars following transport	13.0	17

"Of the total number of fatalities, 72% were poisoned as a result of insufficient safeguarding of containers; these were the most severe poisonings with a fatality of 34.5%.

"In connection with the poisonings which had occurred, various means of contact with tetraethyl lead by the population could be established: burning of fuel contaminated with TEL, using ethylated petroleum products for lighting lamp wood in stoves, using leaded gasoline as a fuel for 'primus' stoves and for lamps, drinking beverages, mainly alcohol from containers contaminated with TEL, using ethyl fluid as an insecticide against bedbugs, utilizing boards soaked with TEL for bed boards, using rubber, contaminated with TEL as mending materials for shoes, transporting ethyl fluid in the same vehicle with foodstuffs and household commodities, using railroad cars, which had not been properly cleaned after carrying ethyl fluid, for transporting persons,

carrying persons in open, unprotected railroad cars together with ethyl fluid, using ethylated petroleum products as a solvent for rubber cement and paints, etc.

*The frequency and number of poisonings as grouped by us according to possibility of contact, are illustrated in Table 2.

TABLE 2.

Cause of poisoning	Number	
	Occurrences of poisoning in % to total number	Victims
Burning contaminated fuel	26.0	12.8
Drinking contaminated beverages	21.7	10.5
Use of ethyl fluid for every-day needs	13.6	42.3
Motor transportation with house- hold goods	13.6	11.1
Use of railroad cars contaminated by ethyl fluid	13.0	17.0
Use as solvent	8.7	6.3 "

While this paper is 14 pages long, it seems unnecessary to quote more of it here.

Dr. Kehoe also gave me a translation of a paper entitled "Mass Poisonings from Tetraethyl Lead" by Dr. Stanislas Paszkowski of the Neurological-Psychiatric Clinic of the Jagiello University (Director: Professor Dr. Eugeniusz Brzezicki), October, 1947. It is twelve pages long. This paper states that in September, 1946 "a large quantity of a certain liquid was imported into the village of Podzamce near Kielce from the provinces recovered from the Germans. It was bought readily by the local inhabitants, and was used for staining of floors, beds and other wooden objects. It

was stated that the whole village had ample supply of this liquid."

Everyone in the village either died or became seriously ill. A sample of the liquid was analyzed in Cracow and was determined to be ethyl fluid. The paper concludes with the statement:

"I want to conclude with the resolution that each case be thoroughly investigated by the police authorities, in order to secure for the workers who come into contact with tetraethyl lead during their work, hygienic conditions, and in order to stop this new, highly dangerous type of crime."

Dr. Kehoe also said that there was a horrible situation in Japan following the entry there of American troops. Tetraethyl-lead was in all kinds of containers, scattered about the country, and a representative of the Ethyl Corporation went over there and corralled all that could be located, to keep members of the public from using tetra-ethyl-lead and anti-knock compounds for all sorts of improper purposes.

Dr. Kehoe was asked whether he, as a medical expert on tetra-ethyl-lead, was of the opinion that it would be in the national interest to have the duPont Company required to divest itself of its business of manufacturing ethyl fluid and ethyl chloride, and for General Motors to be required to divest itself of all interest in the Ethyl Corporation. He said he would answer this way:

Several years ago, after duPont began to compete actively with Ethyl Corporation, the Ethyl officers began to look into their financial situation, to determine in what ways their costs of doing business might be reduced. The Safety Department

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which supervises all tank cleaning operations throughout the country, was costing Ethyl about \$600,000 a year, and one or more Directors of Ethyl thought that too much money was being spent on this operation without any direct return, and that some of this expense should be cut down. The suggestions included cutting down on the inspections of tank cleaning, etc. that the Company had been making.

Dr. Kahoe went to see Mr. Shea, President of Ethyl Corporation, and told him that, in his opinion, the safety and indeed the very existence of the business depended upon the continuance of this work. He said that there are new officials in the Public Health Service who are not acquainted with what happened between 1924 and 1926; that there is no one in the country today outside of the duPont Company, the Ethyl Corporation and their employees, who knows or appreciates the dangers of tetra-ethyl-lead and the possibilities that exist for great harm and danger. He said that the only agency that exists in the country to insure the safety of men who work in the oil refineries, at the bulk plants and filling stations, and people who are engaged in the transportation of ethyl fluid, is the Ethyl Corporation and the duPont Company; that these two Companies have promulgated strict rules for the protection of everyone who comes into contact with tetra-ethyl-lead, and that there is no where in the United States any enforcement of these rules and regulations except by these two Companies. If these rules are relaxed and their supervision ceases, careless handling inevitably will result, and any careless handling of this product inevitably will result in poisonings or deaths. How widespread these will be of course

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tion should occur, according to Dr. Kehoe, there will be another hue and cry against "looney gas", with restrictive statutes, ordinances and regulations, the nature and extent of which cannot be foreseen.

Mr. Shea, of course, was relatively new to the business, and asked Dr. Kehoe to address the Board of Directors, which had on it some men who had not been associated with the Company as long as some others. He said he did this, and the appropriations for safety and for inspections were not reduced.

Dr. Kehoe says that in any event ordinances, statutes and public regulations cannot begin to do the job for the protection of the business and the safety of the public that has been done over the last 25 years, and is now being done, by the duPont Company and the Ethyl Corporation. These two Companies appreciate the dangers of the product and its handling better than anyone else, and the best possible protection will be given, he says, by these two Companies who are protecting their own business at the same time they are protecting the public. Dr. Kehoe said he went so far as to tell the Board of Directors that he was convinced that if they did not continue to spend large sums of money to protect their business, they might expect to wake up some day and have no business.

Dr. Kehoe says that in his opinion, while the Boards of Directors of duPont Company and Ethyl Corporation will change over the years, nevertheless those corporations have direct contact with the product and are thoroughly conversant with the

dangers, and the public interest, in his opinion, will best be served by leaving the control of this dangerous product to them. He says furthermore, that from time to time small operators have commenced the business of making tetra-ethyl-lead, and in every instance they suffered poisonings, to a greater or less degree. He says that very recently he was consulted by a graduate engineer who had formerly been employed by the duPont Company, and who told him that he was raising capital to go into the business of manufacturing tetra-ethyl-lead in California. Dr. Kehoe told this gentleman that he should not think of entering the business without he had large capital, was aware of the dangers, and would build a plant in a completely closed process of the very latest design. This gentleman said he had a complete set of blueprints of a lead plant, and knew what he was about. Dr. Kehoe asked him to describe generally what kind of plant he intended to build, and he said it was to be a plant in the open air. Dr. Kehoe says he told the man that he knew from this one remark that he did not know what improvements had been necessary, and that no open air plant could possibly be safe. He also said that he warned the man that he would have to provide very expensive containers for his product if he entered the business, for the protection not only of himself and his employees but the transportation companies that handled the product.

Dr. Kehoe for some years has been taking samples of the air at street corners in Cincinnati where traffic is most dense, samples of the air in the area of factories that burn soft coal, and in areas in the country where there are no fumes

from automobiles or from factories. He says the greatest concentration of lead in the air is in industrial areas where soft coal is burned, and that there is little difference in the lead content of the air at busy street intersections than in the country. He explains this by saying that the particles of lead that leave an operating gas engine are so minute that they seem completely to disappear, and that he has been able to discover no danger to the public from lead fumes, on city streets or in vehicular tunnels.

Right now Dr. Kehoe is conducting experiments on a student in his laboratory, with the idea of discovering how much of the fumes of tetra-ethyl-lead remain in the system after inhalation. He has a room equipped with absolutely controlled air intake and escape valves, the lead content being controlled by the burning of tetra-ethyl-lead over a propane gas flame as it goes through the intake, and the lead content of the student's food and all excretions being accurately measured. His blood count, blood pressure, etc. are carefully checked periodically. The laboratory has developed extremely accurate means of measuring the lead content of the air, the blood, etc. Dr. Kehoe says that when this experiment ends, after about ten years, he hopes to be able to determine whether an individual excretes all of the lead fumes he would inhale on a public street, or whether he builds up a resistance and after taking in a certain amount of lead takes no more, etc.

Dr. Kehoe further told me that from time to time Ethyl

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has been requested to sell tetra-ethyl-lead in its pure form, that Eli Lilly & Co. is now purchasing it, and that it is being used as an insecticide on certain seeds. He said that whenever anyone has requested to buy it, the Ethyl Corporation has made careful inquiries as to who the purchaser was and the use intended to be made of the product. The reason for this is that the material is so dangerous that, on his advice, the Corporation adopted a policy of declining to sell it to anyone without being fully informed as to the reliability of the purchaser, and that the use intended to be made of the product was proper.

COMMENT

From his cross-examination of Irene duPont, it is obvious that Mr. Hotchkiss intends to go into the poisoning question to a greater or less extent. It seems to me that very serious consideration must be given to the problem whether or not to have Dr. Kehoe testify on this subject before the Court, and recite the dangers that are inherent not only in the manufacture of tetra-ethyl-lead, but in its blending into anti-knock compounds, the shipment of such compounds by tank car, drum and truck, and the cleaning of tanks. So far no tank car of tetra-ethyl-lead has been burst in any railroad wreck. If Dr. Kehoe's testimony is presented to the Court, it is difficult to believe that the Judge will restrain either Ethyl or duPont from continuing in this highly dangerous business, that they have operated so successfully and without danger to the public for so many years. Furthermore, it is to be supposed that by the same token the Judge would conclude that it was highly advantageous to

have the General Motors representatives remain on the Ethyl Corporation Board to exercise a certain amount of control over its affairs, particularly in view of Mr. Sloan's statement that General Motors did not go into the formation of the Ethyl Corporation primarily with the profit motive in mind, but rather to advance the interests of the Corporation as a manufacturer of automobiles, for while this primary idea has been served, the Corporation today, as it was in the beginning, is interested in securing better fuel for its cars. The question naturally arises whether such testimony, and the Judge's decision, may possibly result in legislation to control the manufacture, blending, transportation and sale of products containing tetra-ethyl-lead. No answer can be given to this, but it would seem to be better to have any such legislation follow the trial of an anti-trust suit like this, than to have it follow a holocaust and a public clamor against "looney gas". Such testimony, furthermore, might deter a responsible chemical company from entering this business, which involves not only dangerous manufacture, but continuous dangers thereafter to the public. Moreover, the fact that Ethyl and duPont have conducted their businesses with such care for a quarter of a century, would probably be an inducement to the Court to leave well enough alone. Furthermore, in the light of this performance, it would probably be difficult to have any legislation enacted.

On the whole, it would seem that both General Motors and duPont will receive no small credit from the Court for the way this business has been conducted if the full story is told,

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and we might be missing a fine opportunity to enlighten the Court if the story is not told.

J. D. Carpenter

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