

Hilgedal

LAW OFFICES OF
PILLSBURY, MADISON & SUTRO
STANDARD OIL BUILDING
SAN FRANCISCO

February 8, 1935.

 v. Standard Oil
Company of California

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

Dear Dr. Kehoe:

Thank you for your letter of February 5, 1935.

It is indeed unfortunate that we did not have the benefit of your testimony at the trial in which the Standard Oil Company of California was sued for damages for claimed tetraethyl lead poisoning. As it will be necessary for us to file an affidavit on or before ten days from today we have taken the liberty of drafting an affidavit which we understand is in accord with your views. We enclose the original and a copy for your files. If it is satisfactory to you, please execute the original and have it verified before a notary public in your city and also have the notary's certificate exemplified or certified by a clerk of one of your courts of record. The clerk will know of the form of certificate which is necessary to make the affidavit admissible in our court proceeding. If you find it necessary to make any changes or additions in the affidavit please feel free to do so. This will necessitate redrafting and retyping the affidavit and you will necessarily have to arrange for this to be done. If it

KE 0011649

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is necessary to consult an attorney to assist you in doing this, do not hesitate to do this and advise him to forward his bill to us. We have previously written to you concerning reimbursement for any costs you may be put to and also a charge for your services.

You will note that the affidavit refers to and incorporates the article in the March, 1934 issue of The Journal of Industrial Hygiene. We will arrange to attach this article to your affidavit when we receive it back from you.

We again remind you of the need of expedition and haste in returning the affidavit to us.

Yours very truly,



Encs.

P. S. Possibly the matter might be expedited if before making any changes in the affidavit you discuss them over the telephone either with me or with Mr. Eugene D. Bennett of my firm. For your further enlightenment I am enclosing portions of the transcript which I have had copied so you may see just what it was that was said.

F. T. S.

KE 0011650

In the Superior Court of the State of California, in and for the
City and County of San Francisco

 Plaintiff,

vs.

No. 244538

STANDARD OIL COMPANY OF
CALIFORNIA, a corporation,

Defendant.

AFFIDAVIT OF ROBERT A. KEHOE

STATE OF OHIO,)
) ss.
County of Hamilton.)

ROBERT A. KEHOE, being first duly sworn, deposes and says:
That I am now and for more than ten years past have been a graduate
physician and am now associate professor of physiology of the
College of Medicine of the University of Cincinnati; that for more
than ten years past I have been engaged in extensive investigations
concerning and involving lead hazards associated with the distribu-
tion and use of gasoline containing tetraethyl lead; that I am the
Robert A. Kehoe quoted and referred to in and by Public Health
Bulletin No. 158 of the United States Public Health Service, dated
August, 1925, and am one of the authors of the article entitled
"An Appraisal of the Lead Hazards Associated with the Distribution
and Use of Gasoline Containing Tetraethyl Lead," published in the
March, 1934, issue of The Journal of Industrial Hygiene, Vol. XVI,
No. 2. A copy of said last mentioned article is attached hereto and
marked Exhibit "A." That the facts, conclusions and opinions stated

in and by said last mentioned article were set forth and expressed therein as the result of my studies and investigations aforementioned and the studies and investigations of the co-authors of said article, to wit, Frederick Thammann and Jacob Cholak, and that the statements contained in said last mentioned article are, to my knowledge and belief, true and correct.

In so far as the aforementioned public health bulletin or to my knowledge any other public health bulletin is concerned, there is nothing said by me or attributed to me to the effect that there is danger of lead absorption as the result of exposure to gasoline containing tetraethyl lead and as pointed out, illustrated and stated in the aforementioned article published in The Journal of Industrial Hygiene in March, 1934, there is a complete and definite distinction and difference between the toxicity and danger of lead absorption from concentrated tetraethyl fluid and the gasoline treated with such fluid. This distinction and difference is illustrated and made apparent by the fact that whereas there have been substantiated cases of lead poisoning from the handling of and exposure to the concentrated tetraethyl lead fluid, there is, so far as I know or am advised, no substantiated case of lead intoxication or poisoning up to the present time in the United States as the result of exposure to gasoline treated with tetraethyl lead in the commercial form in which said gasoline is distributed, which is approximately one part of tetraethyl lead fluid to 1,000 or more parts of gasoline. Among the reasons for this being so is that while tetraethyl lead alone or in high concentration in gasoline is rapidly absorbed through the skin, its absorption is retarded greatly by dilution in gasoline. I have been unable to obtain evidence of lead absorption through

the skin of experimental animals after their prolonged exposure to one part of tetraethyl lead to 1,000 parts of gasoline by volume. The dilution of tetraethyl lead with gasoline also largely eliminates the danger of lead inhalation. The difference between the volatility of tetraethyl lead and the various gasoline bases with which it is mixed is so great that approximately one-half the gasoline may be evaporated before lead can be found in the vapor. It is my opinion, therefore, that the vapors arising from leaded gasoline do not contain appreciable amounts of lead.

I have had presented to me the hypothetical case of a man between the ages of 45 and 50 years employed as a pumpman aboard a vessel carrying gasoline cargo and who states that he was present in a pumproom of such vessel during the time it was discharging cargo for a period of approximately six hours, during which time he was exposed to the fumes of tetraethyl gasoline and contact with such gasoline on his hands and feet; that the ventilation in said pumproom was poor due to the failure to operate of certain mechanical means of ventilation; that while he suffered some nausea, headache and other aches and dizziness he nevertheless was able to continue his duties in said pumproom aboard said ship for several hours after the aforementioned exposure and for a number of days thereafter continued to regularly perform his duties aboard said ship without hospitalization or medical treatment and that approximately a year or a year and one-half after such exposure he was physically examined and there were found no signs of stippled blood cells, lead line on the gums or anemia, but in the opinion of the examining doctor there was a disturbance or destruction of certain nerve senses and control. From such hypothetical case it is my opinion that such person had not suffered lead intoxication or poisoning and that such stated resulting nervous disorder is not attributable to lead

poisoning or lead exposure in the particulars and extent stated and such opinion by me would not be altered even though such person had previously been exposed to contact with tetraethyl gasoline or contact with the residue, if any, accumulating in and about the place or places where he was accustomed to work. In other words, if such person had previous contact with tetraethyl gasoline or its said residue and had ingested lead by reason thereof, in my opinion the particular exposure at the time and place above mentioned would not sufficiently or at all aggravate the extent of lead accumulation in the body of such person sufficiently to cause or result in the symptoms or disability claimed, or any disability.

Subscribed and sworn
to before me this _____
day of February, 1955.

EXTRACT OF TESTIMONY - [REDACTED] V. STANDARD OIL
COMPANY OF CALIFORNIA

Direct Examination of DR. GEORGE L. BAKER

MR. FORD: Q. Your name is George L. Baker?

A. Yes.

Q. And what is your profession? A Physician and surgeon.

Q. And, Doctor, of what school are you a graduate?

A. University of Pennsylvania.

Q. And when about did you start practicing?

A. I started private practice in San Francisco in August, 1927.

Q. And have you practiced here since that?

A. I have.

Q. Doctor, did you have occasion--I will fix the date later on--to meet Mr. [REDACTED] the plaintiff in this case?

A. I did.

Q. And have you seen him from time to time since that?

A. I have.

Q. And have you made frequent examinations?

A. I have.

Q. Doctor, without--first, before I put any hypothesis to you--did this examination--was this a complete physical examination?

A. It was.

Q. Doctor, if you assume that Mr. [REDACTED] prior to March 10, 1932,--keep the date in mind--was in the employ of the defendant in this case as a pump man on one of its tankers carrying gasoline and that on a trip shortly before March 10 the blower in the pump room was completely out of order, so that the room was not being ventilated, and that Mr. [REDACTED], for a period of about six hours, was subjected to the fumes of Ethyl gasoline; and to--because of certain leaks, also not only the breathing of the fumes of Ethyl gasoline because of no ventilation, but contacting it, the floor was wet, his feet were constantly wet with gasoline, his working around pumps where at times there were leaks so that it was on his skin; he was back and forth and would go up on deck and stay for a few minutes and come back into the pump room; go up for the purpose of drying himself out and getting some fresh air and come back into the pump room where he was again subjected to the fumes; that following this period of being subjected to those fumes and contacting this gasoline he became nauseated, and he had a feeling come on of a deadness in his feet; his skin became--I am trying to think of the term they used--sensation on his skin; his lungs hurt him; his stomach, he had pains in his stomach; his nose and throat were irritated and his skin felt irritated; he left the ship on March 10 and has not contacted gasoline since; he has remained away from it; that is, March 10, 1932. Now, with that brief history and with those matters that I have given you that he claims that he felt and taken in connection with your examination, will you tell the jury what examination you made and what your conclusions were as to any condition you found.

THE COURT: Can you recall that question? There is no objection to that, Mr. Bennett?

MR. BENNETT: We would have objected to it except this: he is calling the doctor out of order; and having consented to the doctor being called out of order, we are hardly in a position to lay any objection to any foundation.

MR. FORD: I don't want to put Mr. Bennett to any disadvantage; while it would be quite a disadvantage to the doctor, I would rather bring him back.

MR. BENNETT: I am not making the objection, because I have agreed that he may be put on out of order. I do not feel--

MR. FORD: I don't want you to put me in a position--

THE COURT: I just wanted to be sure of that, because Mr. Foster is replacing Mr. Sims for the purpose of taking testimony, and I didn't want there to be any difficulty about the repetition of the question by reason of changing reporters.

MR. FORD: Before you leave, let me add to that question just one thing.

Q. Doctor, will you also assume that Mr. [REDACTED] following the matter I have just related to you, became extremely nervous; that he slept poorly, having difficulty going to sleep; when he would go to sleep would wake up with a start and what he would call bad dreams, such as accidents and so forth, and that this nervous condition has continued up to and including the present time, and these other conditions have continued from then on up to and including the present time.

MR. BENNETT: Of course before this question is answered and in the light of your Honor's question to me, I do not want it to be conceded in any sense that we agree that the facts are such as recited by Mr. Ford nor that there is sufficient foundation; but I am not making objection at this time to the doctor's testimony, because of the fact he is called out of order.

THE COURT: Of course, Mr. Bennett, it is understood that any answer to any hypothetical question is necessarily based upon the proof of the facts stated in the hypothesis, and if any of them are not proven, of course the hypothesis is not complete and the answer would fail to that extent; that is understood always; but you are not objecting to the particular question being answered now on account of the doctor being called out of order?

MR. BENNETT: Yes.

MR. FORD: Your Honor will have in mind, please, that I have not aimed to give the doctor anything that does not already appear in the evidence.

THE COURT: I know you are trying to do that, Mr. Ford.

MR. BENNETT: I do not concede that that is so, but there is no need to argue about it at this time.

THE COURT: It is substantially correct, at least; there may be one or two items in it that may have to be cleared up later that we may have a record of it so that the doctor can answer the question. Do you recall it, Doctor? A. It was a hypothetical question, your honor, regarding whether I thought it possible that this exposure in the pump room was causing these things of which this man complained.

THE COURT: That is also based, I think, upon your examination.

MR. FORD: I was going to call his attention to that.
Q. Have you included in your answers an observation of the man?

THE COURT: That is correct.
A. That is correct.

MR. BENNETT: May I ask the doctor a preliminary question as to when this examination was made?

THE COURT: Yes. I think that is fair.
Q. I first saw Mr. [redacted] on July 7, 1933, at my office. He gave me a story of having been exposed to these fumes of Ethyl gasoline aboard this tanker, the "Harper".

A. BENNETT: Q. That is July 1933? July 7, 1933?
A. That was the first time I saw him.
Q. Did he also give you the dates as to when he was aboard the "Harper"? A. I have a few dates here.
Q. He told you it was over a year previous to that time that he left the "Harper"? A. Yes, exactly; it had been over a year. At the time that I saw Mr. [redacted] the first time his principal complaints were of general bodily weakness, shortness of breath, pains in the chest and abdomen, headache, dizziness, tingling, which he described as pin and needle sensation in the feet and hands; he was constipated; he had poor memory and disturbed sleep. His temperature was normal. His pulse was slightly elevated. His blood pressure was within normal limits. The past medical history, as far as serious illness was concerned, was negative. He had had his tonsils removed. His story at that time was that he was in good general health until the onset of the present illness, which came on while at work aboard the steamship "Harper" where there was a breakdown in the pumping equipment, causing a leakage of a great deal of Ethyl gasoline into the pump room where he was working. He also said that he was sprayed with Ethyl gasoline, which ran onto his hands and arms, and soaked his clothing and shoes; said there was no equipment operating in the pump room to provide fresh air, and the fumes of gasoline were very strong, making him dizzy and weak, and making the eyes smart. Several times he went to the deck for fresh air, and to let his clothes dry out. Following above incident, he gradually became weak, short of breath, with pains in the chest and stomach and pins and needles in the feet and hands.

MR. FOLE: Q. Doctor, could you go a little slower? The reporter may be getting it but he is having a tough time. A. O. K. The bowels became constipated this time, and the stool was black. The skin was pale. There has since been much roaring in the ears and sleep has been poor, restless, with annoying and disturbing dreams. And at no time was there loss of consciousness. There was for a considerable time following the above incident a burning sensation on urinating. He now tires very easily. There has been no loss of sphincter control. That means the valves that regulate the bowels and bladder.

MR. BENNETT: Q. You say, Doctor, there was no loss of control.
A. There was no loss of sphincter control.
Q. You mean by that, it was normal? A. Yes. On physical examination I have the following notes: that he appeared underweight; that the skin and mucous membranes were not pallid or indicative of jaundice; his teeth were in only fair condition. There was no lead line observed on the gums. The pupils of the eye had the normal reactions to light and distance. The gait--that is the mode in which he walked--was of stogy type, but he did not actually stagger. His posture and station, as we call his mode of standing, was of normal type. He did not stagger when his feet were put close together and his eyes closed.

THE COURT: Q. That is the Babinsky test?
A. That is known as the Romberg. The Romberg reaction was not present.

THE COURT: Q. No Babinsky taken.
A. I am getting to that, your honor. Nose and throat; there was nothing remarkable about them. In regard to the ears: he had fair hearing, and on examination with an otoscope, that is, looking in the ear at the drum, was normal. He presented increased knee jerks--

which I might remark has been--the knee jerks have been increased every examination I have made since. There was no undue weakness of the extensor muscles. I might say by the extensor muscles we have particularly in mind the muscles that raise the wrist and the muscles that raise the foot. He had no loss of sense of position of the limbs. With his eyes closed they are pointed up, down, sideways, and so on. He could find that out every time. In moving, in quick movements of the hands and feet he had complete control and was able to move them rhythmically and in the proper order. In the extremities he showed ability to differentiate hot and cold and also sharp and dull. The Achilles reflexes--that is the jerking motion that was gotten from tapping the Achilles tendon back of the heel, was very slow, and we had to give him what we call reinforcement in order to bring that out; we had to have him pull one hand against the other. In that way the reflexes were brought out, but they were never of normal quality. He also had a very definite intention tremor of his hands; in other words, when he would hold his hands there was a very coarse sort of tremor. The impression at that time, on first seeing Mr. Liljedal, was that he had some degenerative changes of his brain and cord, and that, due to the history he gave me I thought they were likely due to Ethyl lead intoxication. However, I felt at that time that primary anemia had to be excluded and suggested that he have a blood count. That blood count was taken on July 2, 1933, with the following results: he had hemoglobin 97 per cent, which is well above normal, we might say. A normal for an adult man is 85 to 90 per cent; Mr. Liljedal had 97. He had 5,410,000 red cells, whereas, we might say 5,000,000 about represents the maximum normal. He had 10,750 white cells, which we might say is within normal limits; and that the relation of the hemoglobin or the coloring matter in the blood as to the number of cells is represented by the factor .91, which is within normal limits, and not indicative of a pernicious anemia. He was in the office again on July 8. I made a few more examinations of him. Again the patellar--that is the knee jerks--was exaggerated. There was no Babinsky response elicited on scratching the bottom of his feet. There were varicose veins of the legs noted, with scarring from operation. He had mucous membranes and skin that showed neither pallor nor pigmentation. The spleen was not palpable. The heart was within normal limits, and there were a few coarse rules in the chest. Rules, I might add, are caused by stickiness and mucous and so on in the various tubes and air spaces.

THE COURT: That is an abnormal sound?

A. That is an abnormal sound. In this case I take it indicative of possibly being from bronchitis, due to the fact that he had no fever and no evidence of any pneumonic process going on. We saw him again on April 13, 1934. At that time all of his previous complaints, except his constipation were present. Examination was as previously, except that there was a doubtful Romberg reaction obtained. May 9, 1934. He feels about the same, and complains greatly of pins and needles in the feet and hands, and of poor sleep. The examination at that time was the same. On June 13, 1934, his complaints were as before. Knee jerks continue hyperactive; ankle jerks are sluggish. There is no loss of pupillary reaction and no loss of sphincter control. August 3, 1934. Knee jerks were very lively. Ankle triceps biceps reflexes were more active than previously. The skin and membranes were found to be normal. There was no lead line on the gums. August 21, 1934. All of the original complaints continued unchanged except for slight if any increase in general strength. He dreams. His dreams continued to be disturbing, causing a disturbed rest. And numbness, the tingling and deadness of the feet and legs and to a less extent of the hands. He continued to complain of staggering, and his gait, I might add, was practically the same as it was the first time I saw him. This staggering when he walked was particularly noted, by the way, when he went to turn sharply on a corner or something.

observed?

A. Of that I observed of the patient.

A. The rambling gait, you mean?

A. No, I said "staggering" not "stammering"--"staggering."

A. I thought you said first, "rambling"--rambling gait.

A. Rambling gait, not speech.

Q. Didn't I understand you in the first part of your testimony to say that he did not stagger?

A. There was no true stagger as we know it, such as a drunken person would exhibit, but his gait was not that of a normal lively individual.

Q. It was a rambling gait as you described it?

A. Yes. His complaint of dizziness was unchanged. He was at that time--on August 25, 1934, he complained of a continuance of this pain in the lower chest, both front and back, and over the entire abdomen. That, by the way, got worse periodically. He would have several attacks where the distress in the abdomen would become worse, from two to five times a day, which would last from--ordinarily last from ten to twenty minutes a time.

MR. BENNETT: Q. Forgive me for interrupting him. You are now recalling things that he told you, Doctor?

A. Things that he called my attention to, that is true. He complained continually of having a bad taste in the mouth, particularly in the morning, and almost always had a frontal--that is a forehead--and a temporal--side of the head--headache; and he had this tremor in the hands. At that time his general condition was good; his color was improved. By the general condition, I might say we would compare the general condition at that time with what he had shown on previous visits to the office. Again on August 29, 1934, general condition was unchanged; the intention tremor--that is the tremor in the use of the hands--is more pronounced. There is no tremor of the tongue. The pupils were reacting normally, and his general strength was improved but he still complained of tiring easily. September 19, 1934, complaints as previously. There is no loss of thermal sense in the hands or feet. By thermal sense we mean the sense that differentiates heat and cold.

MR. BENNETT: Pardon me, Doctor, for interrupting again, but you are going so fast I didn't quite get that. Would you mind repeating the last answer. A. On September 19, 1934, his complaints were as before. On examination we found there was no loss of the thermal sense, which is the sense of differentiating heat from cold.

MR. BENNETT: Q. In other words, you mean by that that in your tests, so far as you could observe, he could determine?

A. Yes, we use two test tubes which are exactly similar in appearance, and in one of them we put ice water, and in one of them we put very hot water. And by covering his eyes we test particularly the hands and feet and legs, these areas he has complained of, to see whether there is any inability to tell heat from cold. Each time we would touch he says, "hot" or "cold"; and if he gets it right we say he is O. K.; if he misses them, then we know that there is some loss of that sensation.

Q. Just one minute. Your tests showed that he had normal function; that he could distinguish between them?

A. That is true.

Q. And that his thermal sense, therefore, was normal?

A. There was no loss of sensation of the--there was no loss of sense of position of the fingers or toes. There was some decrease in his vibratory sense, which we tested at that time. In other words, that his sense of vibration that we get from touching some bony prominence, such as the bone around the knee or around the ankle, with a vibrating tuning fork--ordinarily a person is able to pick that up very readily.

He had a condition there where he was not certain many times whether the tuning fork was vibrating or whether it was still. His knee jerks continued to be hyperactive. The last time he was in the office was January 19 of this year--January 19, 1935--when he complained of having a cough, which had been worse at night, and had been troubling him for the past two or three months. His claim was that it was becoming more severe. He had taken some cough mixture without any relief. His nervous system complaints continued unchanged. I tested him again for this thermal sense, which was normal. I tested him for what we call pin-point discrimination, in other words, telling whether they are sharp or dull, which was normal. His knee jerks were exaggerated. His Achilles reflexes were sluggish and required this reinforcement in order to elicit them. Pupils reacted normally, and in his chest we found more of these rales which we had heard once before. In other words, he had a moderate amount of bronchial irritation. There is one thing I might add which has not been mentioned here. In all of the conversation with Mr. Liljedal, and in all of the examinations, that I might say there has been a definite change from normal in the speed with which he answers questions, and in the mode in which he understands and so on. It seems that possibly--we might say it takes a longer time for the question to sink in and register than it would with the normal individual. I too feel that in spite of the fact that he is a man who was not born and raised in this country and who more or less speaks with a dialect, that there is a tendency of this slurring of his speech. I do not feel that he speaks with the moderate--with the average control of his voice that we would expect a normal person to have. In view of the history, in view of the fact that we have not been able to demonstrate on him any pernicious anemia, which at times causes those changes in the nervous system which may simulate this condition which we have in him--I say we have never been able to demonstrate that; his blood has always been about normal; he has not presented some of the other things which we would expect to be present in pernicious anemia by this length of time--I can't help but feel, after considering his history of exposure to this tetraethyl lead gasoline on this one occasion, and the possibility of having been exposed in a lesser degree on previous occasions--I can't help but feel that his trouble is due to lead intoxication with tetraethyl lead.

MR. FORD: Q. Doctor, in tetraethyl lead poisoning, will you tell the jury whether or not a person who has been subjected to that poisoning has some of the appearances of anemia? A. Tetraethyl lead poisoning is not typical of the usual lead poisoning in that it being a volatile material, it is soluble material which is subject to being taken in very rapidly by way of the lung, it will penetrate through the skin, and it can--of course like other lead substances, it can be swallowed; but many times nervous symptoms will develop long before the anemia will develop due to the fact that the stuff is so soluble that the nervous system is damaged before the blood is. However, anemia is a very very common symptom with lead poisoning of any form.

Q. Doctor, let me ask there, so that the jury will be able to understand, in this tetraethyl lead gasoline, if that is the proper name to call it, you say this lead--let me change that and put it this way: in this tetraethyl lead gasoline how is the lead taken into the system where you inhale it or where it contacts your skin?

A. When you take it by inhalation it dissolves through the little mucous membrane lining of your lungs and immediately goes into your blood. It goes in much the same as ether would do if we were to take an anesthetic and the stuff would get into the blood stream causing anesthesia. It belongs in a group of things which we call fat solvents which are absorbed by way of the lung. Also it has the ability to penetrate through the skin and get directly into

the circulation that way.

Q. What is there about the tetraethyl lead gasoline that permits the lead to be directly taken into the blood stream?

A. The fact that it is not a metallic or a solid substance, but the fact that it is a compound made from lead and the ethyl radical, which is a relative of alcohol and ether, it gives that volatility, that ability to vaporize and be absorbed just similar to what ether has done when you give an anesthetic at the time of an operation.

Q. Now, in speaking of this tetraethyl lead gasoline, is there more than one poison in that makeup or compound?

A. Well, the serious one, the one which we consider the most, is the tetraethyl lead fraction, itself. Tetraethyl lead is a definite chemical compound of certain proportions of carbon and hydrogen and lead. However, in the gasoline we have the same fractions which occur in ordinary gasoline which are of a toxic nature, and we also have a third compound known as ethylene dibromide, which is added to the ethyl gasoline in order to make the ethyl gasoline a safer thing to use in an automobile. In other words, if we were not to use the ethylene dibromide, when that ethyl gasoline were burned we would have a condition wherein the lead, in the form of metallic lead, in the form of oxides of lead, such as red lead and white lead and so on--they would be thrown out onto our streets and in our garages, forming dust which would be definitely dangerous to the population at large; but in the use of ethylene dibromide in this gasoline the combustion of the ethyl gasoline then puts the lead in the form of lead bromide, which is a relatively insoluble and a relatively unpoisonous form of lead. But ethylene dibromide itself in the unburned state has toxic qualities.

Q. Doctor, with this combination of the gasoline, the tetraethyl lead, what becomes of gasoline that is spilled on the floor; does it evaporate?

A. Tetraethyl lead boils at a higher temperature than ordinary gasoline. Therefore if we were to spill some on the floor the proportion of evaporation would be much greater in the gasoline element of what was spilled than it would be in the tetraethyl lead element. Therefore the stuff would bit by bit become more concentrated as it laid on the floor and the fraction of that stuff which was made up of tetraethyl lead would become greater.

Q. What effect has the lead so far as nervousness is concerned? How does that manifest itself in a person who has contacted it if lead affects the nervous system--

A. Primarily affects the nerves themselves. It is a direct nervous system poison, causes degenerations and shriveling up and actual destruction of nerve tissue. It is--in the ordinary form of lead poisoning particularly affects what we call the extensor muscles; that is, it gives a paralysis of the nerves which have to do with enervating those muscles which raise our arms and wrists up. It is shown from experience that tetraethyl lead, when taken in massive doses can cause a thing as severe as acute insanity of the most manic type; that the stuff has been shown, in the early days of the manufacture of it, when the safeguards were not ordinarily up to standard, that there were a number of cases--now, I should say offhand there were in the neighborhood of twelve or fifteen cases of acute insanity which came on following exposure to this material. In other words, it shows a predilection right along to affect the nervous system.

Q. Doctor, there is one other matter I want to ask you, and I am asking so the jury will get this: often we have in mind medicines that are taken that have certain poisonous qualities but taken in doses of a size where they are beneficial rather than detrimental to a person. With this lead, this tetraethyl lead, I want you to tell the jury whether or not that is cumulative, if that is the proper word, or whether you could take it in small and large quantities and keep that time after time without detriment, or does the adding--this taking it in through your skin, or contacting it through your lungs, cumulate that lead poisoning?

A. Lead is one of the classical examples of what we call a cumulative poison. If we take in each day the amount that our kidneys and bowels are able to throw off each day we will never have lead poisoning. However, that amount is exceedingly small, and where we get more than the amount we are able to get rid of each day we get a storage of lead, under average conditions, of lead in the bone just the same as lime is tied up in the bone, combined with phosphates. Should a person through some other minor affair--we will say he should get a cold or he should take too many drinks of whisky or he should get on a diet of too much meat and eggs and not enough vegetables, rendering his system temporarily acid, much of that lead will be liberated from the bones, and when that concentration of lead in the circulating blood reaches a certain figure, he will develop symptoms of lead poisoning which otherwise might not be present at all. There is a tendency for the lead to pile up and the symptoms do not occur until the lead in the circulating blood reaches a figure strong enough to cause the change.

Q. Then, as I understand you, the system will throw off a certain amount of lead poisoning so we can throw off a certain amount each day, but beyond that we can't--beyond that, if we take more than that, our system usually stores it.

Q. Doctor, let me ask you then, taking the hypothetical question which I gave you, which is rather meager as compared to your examination of this man do I understand that it is your opinion that he is suffering from tetraethyl lead poisoning?

A. It is my opinion that Mr. [REDACTED] is suffering from the changes that occurred in his nervous system particularly and in the rest of his body to a less extent, following exposure to tetraethyl lead gasoline.

MR. FORD: I think you may cross-examine. One other thing:

Q. I wanted to ask you, Doctor, where a person has been exposed and his system succumbed to the tetraethyl lead gasoline poisoning, if that is the proper way to put it, is that a lasting condition, or will treatment cure you of it entirely, or what is the fact?

A. Well, of course anemia can be overcome; the condition of his bowels and the condition of his chest should tend to alleviate itself after time and rest away from lead, giving him proper diet and so on. But of course these changes in the nervous system, once they are established, they never tend to recover. Those nerves are actually killed and we can't possibly in any way regenerate them.

Q. Will you explain to the jury what part of the nervous system is affected?

A. In view of my examination and observation of Mr. [REDACTED] it is my firm belief that he has several places that are affected. Now, judging from the examination first of all of these knee jerks that have always been exaggerated, that makes you think that somewhere between the spinal cord and the brain there has been some particular motor pathways that have been put out of business. In other words, those jerks reflect that the control from his brain to the muscles has been interfered with but that the pathway between the spinal cord and the muscle is still intact. Therefore, the trouble must be somewhere between the spinal cord and the brain. His symptoms of numbness, the tingling, disturbed sensations in the hands and feet are being taken as indicative of another portion of the spinal cord being involved, namely, what are known as posterior columns, which occur in the back part of the spinal cord.