Rite in Confidential
Cases of TEL Poisoning - Tank Cleaners - Ipswich

THE ASSOCIATED ETHYL COMPANY LIMITED,
LONDON.

A CONFIDENTIAL REPORT ON CASES OF TETRAETHYL LEAD INTOXICATION ARISING OUT OF THE CLEANING OF AVIATION GASOLINE STORAGE TANKS AT POOLE, DORSET, JANUARY - MARCH, 1951.

By DR. PHILIP BOYD.
CHIEF MEDICAL OFFICER

C O N T E N T S.

SUMMARY.

The cleaning of four underground tanks (AFRD) at the installation of Shell Mex & B.P. Limited at Poole, Dorset, was the subject of a contract with Messrs. Simmons and Hawker Limited, of 18 Bolingbroke Grove, London S.W.11.

The tanks had been in constant use by the Air Ministry for the storage of aviation gasoline containing high concentration of T.E.L. between 1940 and 1945. In 1945 they were emptied and had remained so since.

Tank cleaning began on January 19, 1951, and in all seven employees of Simmons and Hawker Limited were involved in the operation, until completion on March 3, 1951.

It appears that the Foreman-in-charge was fully familiar with the potential hazard of intoxication from tetraethyl lead arising in the course of tank cleaning operations and of the recommended precautions to be taken to avoid exposure. Nevertheless, admissions were made that some or all of the men entered the tanks without respirators.

Between February 9 and March 9, four men complained of feeling unwell, one of whom was admitted to hospital and one died. Another one of the four was subsequently admitted to the Middlesex Hospital for investigation. Of the remainder, none made any complaint and subsequent examination showed no significant absorption; it is possible that one was not exposed to the hazard.

CONCLUSION.

From the evidence available and from examinations made subsequently, there is little doubt that three men suffered from tetraethyl lead intoxication in varying degrees. The writer did not

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CONCLUSION.

From the evidence available and from examinations made subsequently, there is little doubt that three men suffered from tetraethyl lead intoxication in varying degree. The writer did not have the opportunity to examine one of those who died, and although there is no evidence to show whether he was similarly affected, in view of his known exposure, the probability of absorption of tetraethyl lead being either the main or a contributory cause of death cannot be disregarded.

The fact that men were exposed to the hazard of tetraethyl lead absorption is attributable to the lack of enforcement of the recommended precautions by the supervisor responsible.

RECOMMENDATIONS.

Since the potential hazard of tetraethyl lead intoxication arising out of the cleaning of gasoline storage tanks is well known, it is recommended that strenuous efforts be made to ensure that the cleaning of such tanks is conducted under the strict and continuous supervision of a responsible person well versed in the recommended precautions and who has the authority and character to enforce compliance with the recommendations.

Philip Boyd

(Philip Boyd).
Chief Medical Officer.

I. PERSONNEL AND SITE INVOLVED.

Tank Owners.

Messrs. Shell-Mex and B.P. Limited, at Poole.

Tank Cleaning Contractors.

Messrs. Simmons and Hawker Limited,
18 Bolingbroke Grove,
LONDON, S.W.11.

Tank Cleaning Employees Concerned.

[redacted]

Details of Tank.

Four underground tanks were involved in the incident. They were each of 4000 tons capacity, 180 feet in diameter, and 20 feet high.

The tanks were in constant use by the Air Ministry between 1940 and 1945 as A.F.R.D. storage for aviation gasoline containing high concentrations of tetraethyl lead. In 1945 the tanks were emptied, leaving approximately 3 inches of sludge on the bottom. In June 1950 the manhole covers were removed and wind sails erected. The tanks were left open until cleaning commenced in January 1951.

II. CHRONOLOGICAL NARRATIVE.

Note: The following details were elicited subsequent to March 12, 1951, upon which date the incident was first brought to the notice of the Company.

January 19, 1951. The following men commenced to work at tank cleaning at the above-mentioned site:- [redacted] and [redacted]. The last was foreman of the gang.

February 2. Shell-Mex and B.P. Limited reported to Messrs. Simmons and Hawker that the tank cleaner [redacted] was feeling unwell, and that it was thought that he was suffering from influenza. On the same day Mr. Howland, tank cleaning supervisor of Messrs. [redacted] and [redacted] wrote to the foreman, [redacted], at the site, and requested that [redacted] should be sent to London, with instructions to report to the Contracts Office. Instructions were also given for each member of the gang, including [redacted] to be medically examined by a local doctor, in accordance with normal routine.

February 12. [redacted] and [redacted] reported to Dr. M.F. Gallop, of 1 Parkstone Road, Poole, who issued a report. (Appendix 'A'). At this time [redacted] feeling unwell, had returned to London, [redacted] was complaining of sleeplessness and weakness, [redacted] was complaining of sleeplessness and general nervousness, and [redacted] and [redacted] had no complaints. All four were reported by Dr. Gallop as showing no evidence or signs of absorption of tetraethyl lead.

February 13. [redacted] again visited Dr. Gallop, complaining of a sore throat. On the same day, [redacted] joined the Poole gang to replace [redacted]

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January 19, 1951. The following men commenced to work at tank cleaning at the above-mentioned site:- [redacted], [redacted], [redacted], [redacted] and [redacted]. The last was foreman of the gang.

February 9. Shell-Mex and B.P. Limited reported to Messrs. Simmons and Hawker that the tank cleaner [redacted] was feeling unwell, and that it was thought that he was suffering from influenza. On the same day Mr. Howland, tank cleaning supervisor of Messrs. [redacted] and [redacted] wrote to the foreman, [redacted] at the site, and requested that Perry should be sent to London, with instructions to report to the Contracts Office. Instructions were also given for each member of the gang, including [redacted] to be medically examined by a local doctor, in accordance with normal routine.

February 12. [redacted], [redacted] and [redacted] reported to Dr. H.F. Gallop, of 1 Parkstone Road, Poole, who issued a report. (Appendix 'A'). At this time [redacted] feeling unwell, had returned to London, Capsur was complaining of sleeplessness and weakness, [redacted] was complaining of sleeplessness and general nervousness, and [redacted] and [redacted] had no complaints. All four were reported by Dr. Gallop as showing no evidence or signs of absorption of tetraethyl lead.

February 13. Capsur again visited Dr. Gallop, complaining of a sore throat. On the same day, [redacted] joined the Poole gang to replace [redacted]

March 2. [redacted] feeling unwell, left the site of work and returned to London to see his own doctor. [redacted] the foreman, in view of the fact that the tank cleaning was partly completed, left instructions for the sealing of the tanks, and for the tracing of a leak reported by the Shell-Mex engineers, and he himself left on weekend leave for London.

March 3. Tank cleaning and sealing were completed, and all that remained to be done appears to have been to check the work.

March 4. [redacted] returned to Poole.

March 5. [redacted] was seen by his own doctor and certified as suffering from neurosis, and unable to follow his occupation. (Appendix 'B').

March 6. [redacted] requested leave of absence for domestic reasons.

March 7. [redacted] was admitted to St. John's Hospital, Battersea, in a confused and agitated mental state. On the same day, [redacted] complained of sleeplessness, and reported to a local medical officer. On this day he took the whole contents of a bottle of sleeping draught, together with a number of aspirins.

March 8. [redacted] was admitted to Poole General Hospital, and later transferred to Dorchester Mental Hospital.

March 9. [redacted] died at St. John's Hospital, unknown to the rest of the team. [redacted] reported to Poole for the first time as replacement for [redacted]

March 10. [redacted] returned to Poole, and heard for the first time of [redacted] admission to hospital. On the same day [redacted] and [redacted] learned of [redacted] death.

March 11. [redacted] was instructed to leave with his gang for Holyhead on March 12, and in proceeding to do this, heard for the first time of Capsur's death. On the same day, Mr. Howland was independently informed that Capsur was suffering from neurosis.

March 12. Mr. Howland was informed that [redacted] had died and that Pearce was missing. A routine post-mortem was performed on the body of [redacted] Messrs. [redacted] and [redacted] communicated with the Company, as a result of

[redacted] from neurosis, and unable to follow his occupation. (Appendix 'B').

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March 8. [redacted] was admitted to Poole General Hospital, and later transferred to Dorchester Mental Hospital.

March 9. [redacted] died at St. John's Hospital, unknown to the rest of the team. [redacted] reported to Poole for the first time as replacement for Capeur.

March 10. [redacted] returned to Poole, and heard for the first time of Hogan's admission to hospital. On the same day [redacted] and [redacted] learned of [redacted] death.

March 11. [redacted] was instructed to leave with his gang for Holyhead on March 12, and in proceeding to do this, heard for the first time of Capeur's death. On the same day, Mr. Howland was independently informed that [redacted] was suffering from neurosis.

March 12. Mr. Howland was informed that Capeur had died and that [redacted] was missing. A routine post-mortem was performed on the body of [redacted] Messrs. [redacted] and [redacted] communicated with the Company, as a result of which a meeting was called for the following day.

March 13. The coroner's pathologist reported that [redacted] died from meningitis following influenza. Messrs. [redacted] and [redacted] interviewed Pearce. [redacted] and [redacted] proceeded to Holyhead. A meeting took place at which Mr. Noble and Mr. Diggs of the Company, Dr. Boyd, and Dr. Cassells of I.C.I. were present. Decisions were taken with a view to establishing the facts underlying the preliminary report by Messrs. [redacted] and [redacted]

March 14. Arrangements were made for [redacted] to be admitted to the Middlesex Hospital for investigation and treatment, and for [redacted] and [redacted] to be sent to Northwich for examination by Dr. Bennett.

March 16. Mr. [redacted] and Dr. [redacted] visited [redacted] at the Dorchester Mental Hospital, to confirm arrangements for the investigation and treatment of this man.

The subsequent development of events is included in the detailed accounts and appendices on the men involved.

APPENDIX 'A'.

DR. M.F. GALLOP AND DR. J.S. ASTBURY.

1 Parkstone Road,
Poole,
Dorset.

12th February, 1951.

Messrs. [redacted] and [redacted]
Lake Estate Site,
Hamworthy.

I have to-day examined 4 of your employees who are working on tank cleaning at the above address.

[redacted]

Complained of sleeplessness and general nervousness.
I can find no evidence of absorption of tetraethyl lead.

[redacted]

Complained of sleeplessness and weakness.
I can find no abnormalities or signs of absorption of tetraethyl lead.

[redacted]

Complains of no symptoms.
Nothing abnormal found on examination.

[redacted]

DR. M.F. GALLOP AND DR. J.S. ASHBURY.

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Poole,
Dorset.

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Lake Estate Site,
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Complained of sleeplessness and weakness.
I can find no abnormalities or signs of absorption of tetraethyl lead.

[redacted]

Complains of no symptoms.
Nothing abnormal found on examination.

[redacted]

Complains of no symptoms.
Nothing abnormal found on examination.

Signed: M.F. GALLOP, M.R.C.S.

Appt. Factory Surgeon.

KE 0020883

APPENDIX 'B'.

62 Falcon Road,
Clapham Junction.
S.W.11.

This is to certify that [redacted] residing at 71 Grant Road, S.W.11, is unable to follow his occupation. NEUROSIS.

SGD. .....

KE 0020884

APPENDIX 'C'.

[redacted] 184 Stockwell Road, London, S.W.9. Aged 26. Male. Married. Two children. Foreman.

This man started cleaning storage tanks with Messrs. Simmons and Hawker in December 1949, and was promoted to chargehand in May 1950. On January 26, 1951, he was put in charge of tank cleaning operations at Poole.

Although aware of the recommended precautions for the prevention of exposure to tetraethyl lead intoxication, he admitted frankly that both he and the men under him, to his own knowledge, frequently omitted to wear their respirators. They seldom wore the sou'westers provided, but always wore their waterproof suits, overalls, rubber boots and rubber gloves. The sludge from the tank had been known to splash his face. As part of his duties he made sure that the overalls and and underclothes were changed once weekly, that the men's boots were washed at the end of the day, and that their hands were washed before meals.

On March 7, 1951, he began to be worried about his wife's health, and took her to Bridlington to visit her parents. On March 8 he returned to London, and, feeling "fed up," decided to take two days off. On March 10 he returned to Poole, and learned that one of his workmen, [redacted] had been admitted to a mental hospital. He was very worried, and on his own initative he drove the firm's lorry, with his gang as passengers, to London. On March 11, he spent the night at Purton, near Swindon, en route to Holyhead, having received orders for his gang to an assignment of tank cleaning there. The same night he overheard the men discussing the fact that another workmate had died, allegedly from a brain tumour. He became very worried, had a few drinks and went to bed, but he could not sleep. He had the feeling that he wished to go to church, which, for

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direction which he hoped would bring him to Bridlington. He received a lift to Swindon, and proceeded to walk in pouring rain to within a few miles of Reading. Here he was picked up, tired and with blistered feet, and was taken to Chiswick by lorry. His recollections of the journey were vague, but he remembered taking a number of buses until he reached his father's house in London at 7.45 a.m. He was let in to the house by a neighbour, and immediately he telegraphed his wife. He then lit a fire and crouched on the floor in front of it. At noon he telephoned his firm office. His wife returned from Bridlington, and, because of her anxiety, took him to St. Helier Hospital at 11 p.m. He was reassured, and returned to his father's house, where he slept well. On March 13 he visited his firm's office, where he was questioned concerning the recent events. His doctor's assistant, whom he saw later, prescribed phenobarbitone.

Following the discussion on the night of March 13, between the officials of The Associated Ethyl Company Limited, Dr. Boyd and Dr. Cassel it was decided that this patient should be kept under observation, and arrangements were made with the Middlesex Hospital, to which he was admitted on March 15, 1951.

On Admission, 15.3.51.

Complaints.

1. Worry.

2. (a) Twitching of the nose.
   (b) A sense of something stuck in his throat.
   (c) A creeping sensation starting above the right ear and radiating backwards and downwards to the right shoulder, aggravated by telephoning or wearing ear-phones.
   (d) Transient loss of focussing power of the eyes.
   (e) Transient feeling of what is known as "deja vu."

The above symptoms had been present in increasing quantity for a period of two weeks. In addition he complained of:

3. A panicky feeling of instability, which occurred for the first time on admission that day. This lasted

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   (e) Transient feeling of what is known as "deja vu."

The above symptoms had been present in increasing quantity for a period of two weeks. In addition he complained of:

3. A panicky feeling of instability, which occurred for the first time on admission that day. This lasted a very short time, and was unaccompanied by other symptoms.

4. Sore throat and cold during the last two days.

Worries.

(a) This patient felt that he was responsible for the death of one of the gang, and the mental disturbance of another, by failing to insist on the precautions he knew that were necessary. He admitted fully that he had known of deaths occurring in similar work on previous occasions, and further that one of the reasons for his laxity was the ambition to be made a foreman, and to increase his chances of this by speeding the work of his gang. This was to be achieved by dispensing with uncomfortable masks.

(b) His wife was now suspected, after four weeks of incomplete recovery from pneumonia, of pulmonary tuberculosis, and was being investigated at St. Thomas's Hospital.

(c) He had unfortunately, with a view to increasing his popularity, got into debt by buying his gang beer.

General Questioning.

Headaches very occasionally.

No fits or faints.

Insomnia present for three weeks, relieved by hypnotics.

Reduced powers of concentration for two days.

Normal sense of smell and hearing, diminished sense of taste.

Metallic taste in the mouth for one week.

A slight nose bleed one week ago.

No dysphagia.

Good appetite.

During the last week he had had a strong desire for spicy foods.

Highest known weight 13 st. 7 lbs., whilst in the army.
Average weight 12 st. 10 lbs.
Present weight 11 st. 10 lbs.

No chest pain, dyspnoea or palpitations.

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Highest known weight 13 st. 7 lbs., whilst in the army.
Average weight 12 st. 10 lbs.
Present weight 11 st. 10 lbs.

No chest pain, dyspnoea or palpitations.

Recent unproductive cough.

Occasional attacks of heartburn after food during recent years.

Micturition normal.

Bowels open regularly.

Never had herniae, haemorrhoids, or varicose veins.

No aches or pains in the limbs, or weakness of arms or hands.

Past Medical History.

Measles and chicken pox as a child.

Three years ago was in-patient at the National Heart Hospital for treatment of sudden attacks of palpitation (Paroxysmal tachycardia). Was given digitalis and phenobarbitone, for nine months. Since then, no recurrence of symptoms.

Never had rheumatic fever, chorea, pleurisy, pneumonia, jaundice or renal disease.

Excision of mole from left posterior axillary when aged nine or ten years.

Crushed left hand in 1947.

He was seen by Dr. Gallop of Poole on February 12, 1951, whose report stated that there were no signs of lead absorption.

Personal History.

Shy, slightly built, average at school, enjoyed games, fond of his father, but at loggerheads with his mother.

Work. 1. Office boy on leaving school.
2. Building.
3. R.E.M.E. (on the Continent).
4. Plumbing and general contracting.
5. Present occupation.

Cigarettes - 15 to 20 a day for the past three weeks, previously X to 40 a day.

Beer. - Up to 10 pints a day until one month previously.

Habitation Abroad. - France and Germany.

Is married, with a wife and two children, who live in Battersea.

Family History.

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Is married, with a wife and two children, who live in Battersea.

Family History.

Mother.	Alive and well.
Father.	
Wife.	
Boy, aged 2 years.	
Girl, aged 4 years.	

On examination:

A pleasant, co-operative, well-built young man.

Temperature 97.4° F.

Cardiovascular System.

Pulse 68, regular.
Blood Pressure 105/45.
Heart sounds I and II in all areas.
Apex beat impalpable.
Radial arteries thickened, slight locomotor brachialis phenomenon.
J.V.P. - N.A.D.
No sacral or ankle oedema.

Respiratory System.

Chest expansion 2½".
Movement symmetrical.
Trachea central.
Tactile fremitus - N.A.D.
Percussion - N.A.D.
Breath sounds normal. No adventitious sounds.
No cyanosis or clubbing.

Alimentary System.

Mouth: Mucosae moist and clean.
No halitosis.
No lead line.
Slight staining of teeth.

Abdomen - N.A.D.

Central Nervous System.

Cranial Nerves.

I - N.A.D.
II and III - pupils equal, central, react to light and accommodation.
III, IV and VI - external ocular movements normal.
V - Motor, sensory and reflex functions normal.
VII - Nothing abnormal.
VIII - Air conduction better than bone conduction.
IX, XI and XII - Nothing abnormal.
Tendon reflexes present and symmetrically equal.
Plantar reflexes both flexor.
Power, tone, light touch and posterior column sensation and co-ordination normal in limbs.

Temperature 97.4° F.

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U.G.S.

External genitalia - Normal.

Urine: S.G. 1010
No coagulable protein or reducing substances.

Skin.

Scars left posterior axillary fold and palm of left hand.
Hands warm and moist.
Recent blister on plantar surface of left big toe.
Lymph glands and thyroid - N.A.D.

Skeleton.

Bilateral fourth and fifth hammer toes.

Investigations:

The following investigations were performed:

Blood.

Haemoglobin 92% (13.3 grams).
R.B.C. 5,000,000.
Colour Index 0.93
W.B.C. 7,400.

Differential Count -		
	Neutrophils	45%
	Lymphocytes	44%
	Monocytes	5%
	Eosinophils	6%
	Reticulocytes	1%

Cerebro Spinal Fluid.

This was performed in the fourth to fifth lumber interspace.

Crystal clear fluid at 105 millimetres pressure, rising to 135 millimetres on jugular venous compression, falling again to 115 millimetres.
Protein - 30 milligrams per 100 mls.
Pandy's test - negative.
Sugar - 61 milligrams per ml.
Chloride - 692 milligrams per ml.
Cells - 1 lymphocyte per cubic millimetre.
W.R. - negative.
Lang - 10 x 0.

Liver Function Tests.

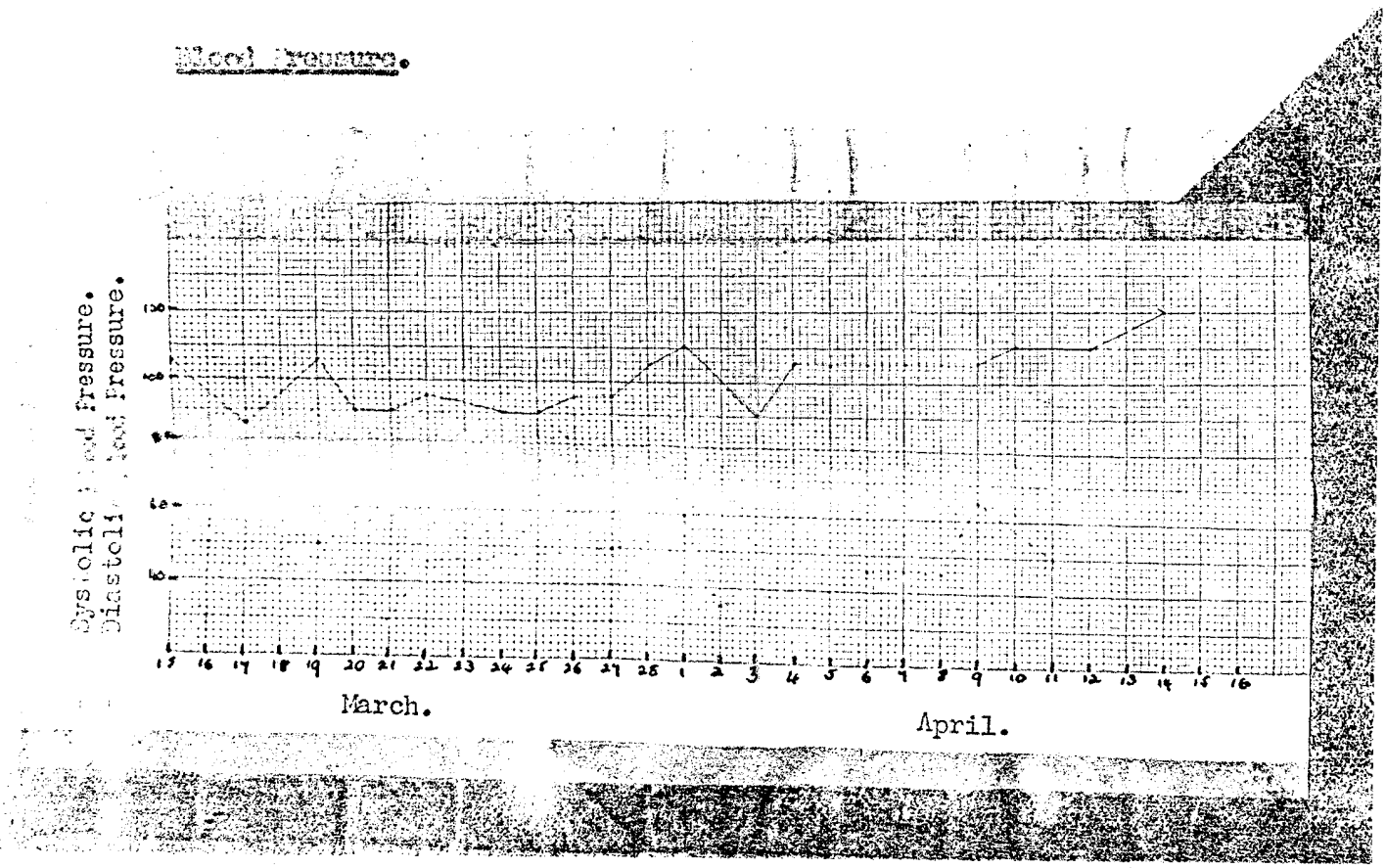
Colloidal gold - negative.
Thymol turbidity - 3 units.
Serum biluribin - 0.3 milligrams per 100 mls.
Alkaline phosphatase - 2.7 units.
Cholestrol - 174 milligrams per 100 mls.

Urinalysis.

Date.	Volume (ml).	Mgm. Pb/ Sample.	Mgm. Pb/ Litre.	S.G.	Standardised Mg./litre 1.014	Remarks.
15.3.51.	337	0.248	0.736	1.029	0.356	(3.65 mls. formalin).
*	Control	0.0066	0.017			
21.3.51.	340	0.165	0.169	1.007	0.393	
10.4.51.	565	0.076	0.135	1.008	0.236	Before X-ray of abdomen
"	185	0.094	0.507	1.023	0.310	4 hours after X-ray.
"	583	0.164	0.282	1.014	0.272	18 hours after X-ray.
12.4.51.	450	0.120	0.266	1.013	0.287	Before X-ray of abdomen.
"	266	0.086	0.324	1.021	0.216	Before X-ray of abdomen.
"	582	0.082	0.142	1.012	0.165	Before X-ray of abdomen.
13.4.51.	435	0.044	0.101	1.010	0.143	2 hours after X-ray.
"	230	0.037	0.162	1.009	0.250	4 hours after X-ray.
"	420	0.160	0.381	1.024	0.22[illegible]	17 hours after X-ray.

* Control = 390 mls. distilled water, 10 mls. formolin.

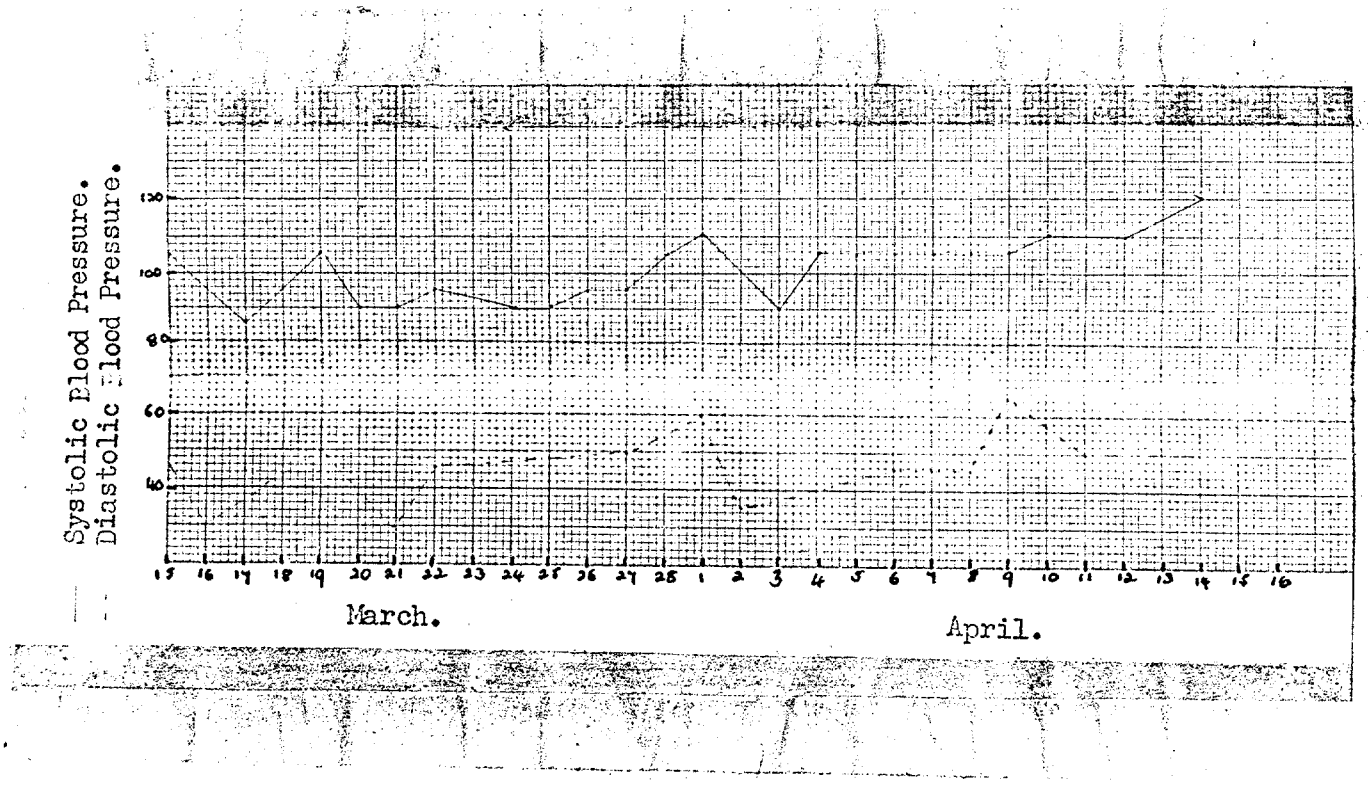
Blood Pressure.



*	Control	0.0088	0.017			
21.3.51.	640	0.165	0.169	1.007	0.393	
10.4.51.	565	0.076	0.135	1.008	0.236	Before X-ray of abdomen
"	185	0.094	0.507	1.023	0.310	4 hours after X-ray.
"	583	0.164	0.382	1.014	0.272	18 hours after X-ray.
22.4.51.	450	0.120	0.266	1.013	0.287	Before X-ray of abdomen.
"	466	0.086	0.324	1.021	0.216	Before X-ray of abdomen.
"	582	0.082	0.142	1.012	0.165	Before X-ray of abdomen.
23.4.51.	435	0.044	0.101	1.010	0.143	2 hours after X-ray.
"	430	0.037	0.162	1.009	0.250	4 hours after X-ray.
"	420	0.160	0.381	1.024	0.22[illegible]	17 hours after X-ray.

* Control = 390 mls. distilled water, 10 mls. formalin.

Blood Pressure.



The diastolic pressure was often difficult to determine.

Electroencephalogram.

2.4.51. This was reported on by Dr. G. Parsons Smith as follows:-

"There was a slow alpha rhythm of 8 per second, and it was disturbed in all areas by runs of low voltage 5 to 6 per second waves, which were most obvious in the central part of the right temporal lobe. Hyperventilation caused the appearance of high voltage paroxysms of 2 per second waves in both frontal regions, and some random 3 per second activity over the rest of the cortex.

Although this record could be part of a constitutional abnormality, it seems most probable that because of the assymetry, the abnormality is an acquired one."

23.4.51. Second E.E.G. reported on by Dr. G. Parsons Smith.

"The E.E.G. record on [redacted] had changed considerably since 2.4.51. The dominant frequency varied between 7 and 9 per second. Its voltage had doubled from 16 μ to 32 μ. In the first record the readings for the parietal regions were comparatively flat and featureless, whereas in this record the 7 per second frequencies were predominant. In the temporal lobe the assymetry described previously is reproduced and as elsewhere had a higher voltage than before.

The response to hyperventilation was also different: within half a minute, low voltage 2 per second waves appeared in both occipital regions. High voltage generalised 3 to 4 per second waves first appeared at 1½ minutes and appeared paroxysmally for the rest of the exercise and for 20 seconds after it. They had not appeared in the previous record, until 2 minutes 20 seconds, and on that occasion were not nearly so marked.

It could be that the cervical activity was suppressed in the first record and that it is now reappearing. The record is still an abnormal one, and it will not be possible to assess these two records

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The response to hyperventilation was also different: within half a minute, low voltage 4 per second waves appeared in both occipital regions. High voltage generalised 3 to 4 per second waves first appeared at 1½ minutes and appeared paroxysmally for the rest of the exercise and for 20 seconds after it. They had not appeared in the previous record, until 2 minutes 20 seconds, and on that occasion were not nearly so marked.

It could be that the cervical activity was suppressed in the first record and that it is now reappearing. The record is still an abnormal one, and it will not be possible to assess these two records until we have found a baseline."

Chest X-ray. N.A.D.

E.C.G. N.A.D.

Plain X-ray of Abdomen.

This X-ray was taken and compared with a plain X-ray of the abdomen of another young man of similar age and physique who had not suffered exposure to T.E.L. An undoubted increase in the density of the liver of the affected man was noticeable.

Progress.

During the period of progress as an in-patient, the following significant notes were made:

1. Recurrent headaches, sometimes frontal, sometimes hemicranial, occurred. Dull continuous pain appeared at any time of the day, and lasted from half an hour to several hours. It was not affected by posture and was unaccompanied by nausea or visual changes. As progress occurred, these headaches improved.

2. Mostly in the early stages, he suffered from sudden attacks of depersonalisation, usually occurring while talking to people, and often in visiting hours. They lasted for about half an hour, and disappeared with his general improvement.

3. A rather persistent sensation of something creeping over his skin on the right side of the head and neck occurred in the early stages of his disease, lasting for hours, and was probably his commonest complaint. He left hospital still complaining slightly of this symptom.

4. His temperature varied irregularly during admission, generally being between 96°F. and 98.6°F., usually on the low side. His pulse during his admission varied between 56 and 94, usually being around a figure of 66 or 70 per minute.

Apart from these symptoms, he showed otherwise no abnormalities, and on April 14, he was considered recovered sufficiently for convalescence.

Opinion.

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Apart from these symptoms, he showed otherwise no abnormalities, and on April 14, he was considered recovered sufficiently for convalescence.

Opinion.

A case of T.E.L. intoxication of moderate severity, showing certain clinical signs and symptoms and confirmed by pathological investigations.

APPENDIX 'D'.

[redacted] Aged 20. Male. Single. Tank Cleaner.

For the past five months this man had been employed by Messrs. Simmons and Hawker in various occupations, and during the previous five weeks was employed in tank cleaning at Poole. He had been fully warned concerning the hazards involved and instructed in the precautions to be observed to avoid exposure to tetraethyl lead, but admitted to working for intermittent periods without his air line mask and gloves. (A copy of the police statement of his movements prior to his admission to hospital is attached in Appendix 'E'.)

On March 9, 1951, this patient was admitted, under certificate, to the Herrison Hospital, Herrison, Dorchester. His past history, family history, habits, etc., were not available, owing to his mental state at the time of admission.

On examination, he was found to be confused, and aurally hallucinated. He was deluded (e.g. he believed he had contractd venereal disease by rubbing against a pole in the park at Bournemouth). His condition mentally was obviously very serious, but his physical state was found to be satisfactory.

General Appearance.

A thin, unshaven, degenerate-looking individual, confused and uncooperative. Pale, but no apparent anaemia.

Temperature 97.6°F.

Cardiovascular System.

Pulse 76 per minute, regular.
Blood Pressure 106/80.
Heart sounds I and II in all areas, no added sounds.
Apex beat was indefinable.

Respiratory System.

Messrs. Simmons and Hawker in various occupations, and during the previous five weeks was employed in tank cleaning at Poole. He had been fully warned concerning the hazards involved and instructed in the precautions to be observed to avoid exposure to tetraethyl lead, but admitted to working for intermittent periods without his air line mask and gloves. (A copy of the police statement of his movements prior to his admission to hospital is attached in Appendix 'E'.)

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Temperature 97.6°F.

Cardiovascular System.

Pulse 76 per minute, regular.
Blood Pressure 106/80.
Heart sounds I and II in all areas, no added sounds.
Apex beat was indefinable.

Respiratory System.

Respiratory rate 20.
Movement symmetrical.
Trachea central.
Tractile fremitus - normal.
Percussion - normal.
Respiratory sounds - normal.

Alimentary System.

Mouth clear.
Abdomen - N.A.D.

Central Nervous System.

Cranial nerves normal.
All reflexes normal.
Plantars ↓ ↓

The progress of this case was very slow, and it was only by June 25 that he could be stated to be almost symptom-free, with occasional night hallucinations which worried him little. By this time he was able to develop insight into his condition, and he was finally discharged from hospital in September 1951.

Five days following his admission, his blood pressure rose to 126/90, and subsequently remained fairly constantly at this level. He was retained in bed continuously until May 24, after which time he was allowed up at small intervals. During the whole period his pulse rate varied from 106 to 50, being most frequently around the lower figure. Throughout his stay in hospital his temperature was persistently sub-normal. His treatment consisted of rest and fluids in large quantities. During the slow progress of his mental condition, a gradual improvement was noted, and as time passed his visual and aural hallucinations diminished. The first to disappear completely were his visual hallucinations.

The following laboratory investigations were carried out:

19.3.51. Haemoglobin 101%
R.B.C. 5,500,000 per cu.mm.
Colour Index 0.92
Leucocytes 9,300
Differential count – Neutrophils 77%
Eosophils .5%
Metamyelocytes 1.0%
Turk cells 0.5%
Monocytes 6.5%
Lymphocytes 14.5%
Reticulocytes – less than 1%
Icterus Index – less than 2 units.
Mean Corpuscular volume – 82 c.m.
Packed cell volume – 47 m.m.
No basophilic stippling.
Platelets abundant.
Fragility – normal.

The progress of this case was very slow, and he was [illegible]

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Mean Corpuscular volume - 82 c.m.
Packed cell volume - 47 m.m.
No basophilic stippling.
Platelets abundant.
Fragility - normal.

16. 3.51. Urine.

S.G. Insufficient sample.
Reaction - neutral.
Albumen - Positive +
Blood - Positive ++
No reducing substances.
No R.B.C., pus or casts.

19.3.51.

The blood was examined for the following substances:

Blood Urea	42 mgm. per 100 mls.
Differential Protein	7.55 grams per 100 mls.
Cholesterol	0.166 milligrams per 100 mls.
Uric Acid	4.1 mgm. per 100 c.c.
Colloidal gold	0 units.
Ammonium sulphide	2 units.
Alkaline phosphatase	9 units per 100 c.c.
Thymol turbidity	2 units
W.R.	Negative.

Urinalysis.

Date.	Volume (ml).	Mgm. Pb/ Sample.	Mgm. Pb/ Litre.	S.G.	Standardised mg./litre 1.014
19.3.51.	4530	1.5	0.331	1.009	0.515
21.3.51.	4630	0.703	0.155	1.004	0.541
2.5.51.	1520	0.102	0.067	1.004	0.234
"	1090	0.048	0.044	1.002	0.308

Faeces.

Date.	Ash Wt. Gm.	Mgm. Pb/ Sample.	Mgm. Pb/ 1 gm. Ash.
18.3.51.	13.3	4.4	0.330
"	8.65	3.04	0.350

Blood.

Date.	Wt. Gm.	Mgm. Pb/ Sample.	Mgm. Pb/ 100 gm.
18.3.51.	6.95	0.0047	0.068
2.5.51.	4.27	0.0053	0.126

Opinion.

Cholesterol	0.166 milligrams per 100 mls.
Uric Acid	4.1 mgm. per 100 c.c.
Colloidal gold	0 units.
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18.3.51.	6.95	0.0047	0.068
2.5.51.	4.27	0.0053	0.126

Opinion.

A case of T.E.L. intoxication of great severity, presenting a full picture of an encephalopathy of prolonged duration, confirmed by pathological investigations.

APPENDIX 'E'.

STATEMENTS RELATING TO WILLIAM HOGAN.

[redacted] landlady gave the following story:

"On the 12th of February, 1951, [redacted] came to my house and was given accommodation. He was very reserved and did not complain of anything.

About 5 a.m. on Wednesday, 7th March 1951, he knocked at my bedroom door and opened it saying, "Shiela wants you." (Shiela is my daughter). I asked him what was the matter and he said, "I don't feel well, I've had no sleep." I gave him some matches and told him to go downstairs and make himself a hot drink.

Within a few minutes I followed and saw him in the kitchen making himself a cup of cocoa. He was dressed in his trousers, shirt and socks and he was shivering. He had his drink and said he had taken five aspirins. I warned him against taking more than two and he said he had taken them to make him sleep. Soon after he went to bed and I did not hear anything of him again.

About 6.5 a.m. on Wednesday, 7th March 1951, he came into the kitchen and appeared all right and said he was very sorry what had happened.. I advised him to go to the doctor and I understand he went to a local doctor in Poole. Just after 8 a.m. he left for work.

He came back about 5 p.m. that same date and said the doctor had given him some sleeping tablets and he went to bed about 9 p.m. in a single room.

About 1.30 a.m. on Thursday, 8th March 1951, I heard a banging noise, and on going out on to the landing I saw his two mates go into the room.

I went to his room and saw [redacted] standing out of bed only in his shirt. He was shivering. When asked what was the matter, he said he had had one of his bad turns. I left and got a hot drink which he drank, it was cocoa. I spoke to him about his behaviour and he sat on the bed and cried.

Before leaving for work later he said he felt very ill and was shivering. He ate his breakfast after some persuasion. He said he was willing to go to the doctor. I telephoned the local doctor of Poole and he told me HOGAN should call at the surgery when he would give him something to make him sleep.

At 5 p.m. the same date [redacted] arrived back and left after tea with his two mates for the doctor's surgery and arrived back about 8 p.m.

[redacted] showed me a medicine bottle filled with a brown coloured liquid. I read out the directions on the label - one tablespoonful to be taken before going to bed. He then left the room.

About five minutes [illegible]

On the 14th of February, 1951, [redacted] came to my house and was given accommodation. He was very reserved and did not complain of anything.

About 5 a.m. on Wednesday, 7th March 1951, he knocked at my bedroom door and opened it saying, "Shiela wants you." (Shiela is my daughter). I asked him what was the matter and he said, "I don't feel well, I've had no sleep." I gave him some matches and told him to go downstairs and make himself a hot drink.

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About 6.45 a.m. on Wednesday, 7th March 1951, he came into the kitchen and appeared all right and said he was very sorry what had happened. I advised him to go to the doctor and I understand he went to a local doctor in Poole. Just after 8 a.m. he left for work.

He came back about 5 p.m. that same date and said the doctor had given him some sleeping tablets and he went to bed about 9 p.m. in a single room.

About 1.30 a.m. on Thursday, 8th March 1951, I heard a banging noise, and on going out on to the landing I saw his two mates go into the room.

I went to his room and saw HOGAN standing out of bed only in his shirt. He was shivering. When asked what was the matter, he said he had had one of his bad turns. I left and got a hot drink which he drank, it was cocoa. I spoke to him about his behaviour and he sat on the bed and cried.

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[redacted] showed me a medicine bottle filled with a brown coloured liquid. I read out the directions on the label - one tablespoonful to be taken before going to bed. He then left the room.

About five minutes after he returned to the room where I was and said, "Phone the police, I must get away, I can't stop here, I'm a sick man." I rang up the doctor's surgery and it was arranged that he would call after surgery hours. I also telephoned the police and ambulance. HOGAN put his wallet and papers on the table and left.

The next time I saw him he was in the hall with his two friends. The police and ambulance arrived and soon after the doctor arrived.

[redacted] had told me that he had had a serious attack of influenza during the epidemic at Liverpool and also that he had pneumonia and did not know anybody. He has never threatened to do himself an injury in my presence."

8th March, 1951.

One of his colleagues, who was with him, gave the following story:

"I have known [redacted] for about a month as he is also staying at the same lodging, and working with me as a tank cleaner.

[redacted] slept in a room with several others and about Sunday, 4th March 1951, he kept walking about in the bedroom and slamming doors, and on Wednesday, 7th March 1951, he was given a room on his own.

About 1 a.m. on Thursday, 8th March 1951, I went to his room with another mate, who was sleeping in my room. The reason we went to Hogan's room was because the latter was mumbling to himself and making a noise. I saw him sitting on the floor with the bed clothes scattered around him. We tried to help him up but he was contrary and would not do anything he was told. Soon after he came up to our room and slept in the next bed. I kept him under observation during the night. He did not sleep but appeared delirious.

About 8.10 a.m. that same date I left him with my other mate at the lodgings and I went to work and [redacted] seemed all right then.

I saw him again about 10.30 a.m. that morning. He did tell me that his sister was getting married and that his mother in Ireland had written to him asking him to go home. He said that he had not enough saved up to go home. He had his dinner with us and appeared normal.

The three of us arrived at the lodgings from work about 5 p.m. that day, the 8th March 1951. We had tea and then went to a local doctor's surgery in Poole, as [redacted] had decided to see a doctor.

The doctor gave him a prescription and he took it to Timothy White's, the chemists, High Street, Poole, and soon after was given a bottle of brown coloured liquid. He did ask the assistant if there were any tablets and she replied, "No." He did not know what the medicine contained.

About 8 p.m. we arrived at our lodgings and [redacted] and I started to play cards but a few minutes after he said he was going upstairs, and left. I got up and said to my mate, "Bill's gone outside." I went out of the dining room and saw HOGAN going out through the main doorway leading to the street. I ran after him and caught hold of him by the arm a few yards from the lodgings, towards the Quay. He said "Don't stop me, Bill, I've drunk all that's in the bottle and I think I will drown myself." He tried to break away from me but my mate arrived and helped me to take him back to the lodgings where we locked the door. The landlady called the police. He kept saying "I'm no good for this world, God ought to punish me," and kept mumbling to himself. Soon after the police and ambulance arrived, and the doctor arrived soon after this, resulting from which HOGAN was taken to the Poole General Hospital. On the way he did not say anything I could understand.

[redacted] worked with us cleaning petrol tanks internally and masks are worn in which case the fumes have no ill effects on a person working

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[redacted] worked with us cleaning petrol tanks internally and masks are worn in which case the fumes have no ill effects on a person working there.

During conversation [redacted] told me that he had the influenza during the severe epidemic at Liverpool and was very delirious. He knew that the medicine prescribed by the doctor was to make him sleep. He has always appeared worried about something."

Another colleague made the following statement:

"I have been staying at the lodgings for the past five weeks, whilst I have been working at Hamworthy.

I have two other mates at the same address, who work with me. One has been with me all the time at the lodgings, and WILLIAM HOGAN, an Irishman, has been there about a fortnight. When he came to Poole, he said he had come from Liverpool, he then had two mates with him who later went on to Portsmouth.

Our work is to clean out the slush and gas fumes in the petrol tanks, for which we wear special masks and boiler suits which we change every day. We finish the tanks by washing the surface at the bottom of the tank. We have done three tanks.

Until about last Sunday, March the 4th 1951, [redacted] the Irishman, has been quite normal. When he came to us he said that he had been in the 'flu epidemic at Liverpool, and that he had been put "out" for two days not knowing what he was doing, the nurses had told him so.

On Sunday March the 4th, he was walking about into other rooms during the night, I did not see him. The following Monday, Tuesday and Wednesday nights he was walking about the house and sitting on the floor crying. He came to work on those days and seemed all right, the trouble occurred at night.

On Thursday, the 8th March 1951, I was going to take him to the doctor's in the morning but the landlady said, "No,",and phoned the doctor and made an appointment to see the local doctor the same night. He went to work in the day and saw a doctor the same afternoon through the Shell Mex people.

That evening we all three mates went to the doctor's in Poole who gave a prescription for medicine, which we obtained at Timothy White's. The doctor advised Hogan to go home to Ireland.

We went back to the lodgings and some of us were playing cards at about 8 p.m. when [redacted] got up and said he was going upstairs.

The next minute the girl Shiela, the daughter of the landlady, came running in and said [redacted] had run down the road to the Quay. My mate and me went after him and brought him back. He said he was going to sling himself in the water.

After we got him back he was wandering in his speech about being a beast and not fit to live. I went to my room and found the bottle on the bed which [redacted] had got from the chemist that night. It was empty and the cork was missing. We later contacted the police and handed them the empty bottle. I went in the ambulance with HOGAN to the hospital and he was muttering all the way."

one has been with me all the time at the lodgings, and WILLIAM HOGAN, an Irishman, has been there about a fortnight. When he came to Poole, he said he had come from Liverpool, he then had two mates with him who later went on to Portsmouth.

Our work is to clean out the slush and gas fumes in the petrol tanks, for which we wear special masks and boiler suits which we change every day. We finish the tanks by washing the surface at the bottom of the tank. We have done three tanks.

Until about last Sunday, March the 4th 1951, [redacted] the Irishman, has been quite normal. When he came to us he said that he had been in the 'flu epidemic at Liverpool, and that he had been put "out" for two days not knowing what he was doing, the nurses had told him so.

On Sunday March the 4th, he was walking about into other rooms during the night, I did not see him. The following Monday, Tuesday and Wednesday nights he was walking about the house and sitting on the floor crying. He came to work on those days and seemed all right, the trouble occurred at night.

On Thursday, the 8th March 1951, I was going to take him to the doctor's in the morning but the landlady said, "No,",and phoned the doctor and made an appointment to see the local doctor the same night. He went to work in the day and saw a doctor the same afternoon through the Shell Mex people.

That evening we all three mates went to the doctor's in Poole who gave a prescription for medicine, which we obtained at Timothy White's. The doctor advised Hogan to go home to Ireland.

We went back to the lodgings and some of us were playing cards at about 8 p.m. when [redacted] got up and said he was going upstairs.

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(In view of the fact that the above reports are included for the purpose of medical interest, all names and identities other than that of the patient have been deleted).

APPENDIX A Police Sergeant made the following report:

8th March, 1951.

Sir,

[redacted] - No Fixed Abode - Attempted Suicide.

I beg to report that at 8.10 p.m. on Thursday 8th March 1951, a telephone message was received at the Police Station, Poole, from the landlady of some lodgings in Poole to the effect that a man there was attempting suicide.

I arrived there at 8.20 p.m. the same date where I saw [redacted] a native of Eire in the hall of the building being restrained by two men who were also lodging there. He was mumbling also saying he wanted to get out of it. The Inspector arrived soon after. I had contacted a doctor of Poole, who had attended this man recently for a nervous complaint. The doctor when told by me that he had refused to go to hospital by ambulance which had arrived told me that to use force may have serious consequences and the he would come at once. He arrived soon after and [redacted] was taken to hospital. I instructed a policeman to go also and keep him under observation. This man was detained and another policeman was detailed for observation during the night, another policeman was detailed to relieve him at 6 a.m. on the 9th inst. pending arrangements being made for civilian observation.

[redacted] was born on the 3rd April 1931, in County Wexford, Eire, and is employed by Messrs. Simmons and Hawker of Wandsworth Common, London, as a Petrol Tank Cleaner at Shell Mex, Lake Estate Site, Hamworthy. He has been unable to sleep and had an attack of influenza during the serious epidemic at Liverpool. On Thursday, 8th inst., he had obtained a bottle of sleeping draught on the prescription given by the local doctor and on his return to his lodgings he drank the contents and attempted to drown himself.

Statements have been taken from the two men with whom he has been working, also the landlady, as no doubt he will have to be charged with attempted suicide, there being no person in the country who will accept any responsibility. It does not appear likely that he will die, and this preliminary report is submitted for your information pending the submission of the file when he is charged.

I am, Sir,
Your obedient servant,

Sergt. No.....

APPENDIX 'F'.

[redacted] Aged 23 years. Single.

This man was employed by Messrs. Simmons and Hawker throughout the period of tank cleaning at Poole, Dorset. On February 12, together with [redacted] and [redacted] other members of the gang, he reported to Dr. Gallop in Poole, on the instructions of his firm. At this time he was complaining of sleeplessness and general weakness. Dr. Gallop, however, signed a certificate to state that he could not find any abnormality or signs of absorption of tetraethyl lead. (Appendix 'A'). On February 13 [redacted] complained of a sore throat, and visited Dr. Gallop again. He was given a tonic and discharged. On March 2 [redacted] still felt unwell, and returned to London for a few days' rest. He then reported to his own doctor. He was certified officially as unable to follow his occupation due to neurosis.

On March 7 he was admitted as an emergency to St. John's Hospital, Battersea, S.W.11, suffering from acute agitation and delirium.

On Examination.

The only abnormality discovered clinically was a reddening of the fauces and tonsils.

He showed severe mental agitation, and undue concern about his throat. On March 9, 1951, he became even more agitated, and restless, and suffered from hallucinations, and at 5.30 a.m. on the same day he collapsed, following a seizure with convulsions, and died.

A routine coroner's inquest was held, and a death certificate by the coroner's pathologist was issued stating that death was due to meningitis following influenza. No analysis was made, either before or subsequent to the death of this patient, to establish

[redacted] Aged 23 years. Single.

This man was employed by Messrs. Simmons and Hawker throughout the period of tank cleaning at Poole, Dorset. On February [redacted] together with Pearce, Barber and Kydick, other members of the gang, he reported to Dr. Gallop in Poole, on the instructions of his firm. At this time he was complaining of sleeplessness and general weakness. Dr. Gallop, however, signed a certificate to state that he could not find any abnormality or signs of absorption of tetraethyl lead. (Appendix [redacted] On February 13 [redacted] complained of a sore throat, and visited Dr. Gallop again. He was given a tonic and discharged. On March 2 [redacted] still felt unwell, and returned to London for a few days' rest. He then reported to his own doctor. He was certified officially as unable to follow his occupation due to neurosis.

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Opinion.

In view of the opportunity for exposure to T.E.L. intoxication and the history of this case, together with the clinical symptomatology, and despite the diagnosis arrived at by the coroner's pathologist and the lack of evidence of lead absorption, a diagnosis of T.E.L. poisoning would seem to be justified in this case.

APPENDIX 'G'.

[redacted] started work at Poole, tank cleaning, in January, 1951. On February 9, 1951, J. Perry reported sick, probably suffering from influenza, and Pearce was instructed to send him back to London.

On February 12, 1951, [redacted] reported to Dr. Gallop, of Poole, on instructions from Simmons and Hawker. They complained of no symptoms, and nothing abnormal was found on examination. (Appendix 'A'). On March 9 W. [redacted] reported to Poole as a replacement for Capsur.

On March 13, [redacted] proceeded to Holyhead for their next job, as tank cleaning at Poole had been completed on March 10.

On March 15, [redacted] reported to Dr. Bennett, part-time medical officer of Associated Ethyl, and they were examined at Northwich. No clinical signs or symptoms of tetraethyl lead poisoning were found. At no time had these men complained of any symptoms suggestive of intoxication with tetraethyl lead, although it was noted that on the whole their urine levels for lead were above the average.

Urinalysis.

Date.	Name.	Volume (ml).	Mgm. Pb/ Sample	Mgm. Pb/ Litre.	S.G.	Standardised Mg./litre 1.014
15.3.51.	[redacted]	166	0.028	0.169	1.011	0.214
"		102	0.0181	0.177	1.021	0.115
"		126	0.0055	0.044	1.009	0.068
28.3.51.	[redacted]	70	0.022	0.314	1.015	0.293
"		172	0.0083	0.051	1.014	0.051
9.4.51.	[redacted]	38	0.0075	0.197	1.017	0.162
14.4.51.	[redacted]	172	0.046	0.268	1.018	0.208

In January, 1951. On February 7, [redacted] suffering from influenza, and [redacted] was instructed to send him back to London.

On February 12, 1951, [redacted] and [redacted] together with [redacted] and [redacted], reported to Dr. Gallop, of Poole, on instructions from Simmons and Hawker. They complained of no symptoms, and nothing abnormal was found on examination. (Appendix 'A'). On March 9 [redacted] reported to Poole as a replacement for [redacted]

On March 13, [redacted] and [redacted] proceeded to Holyhead for their next job, as tank cleaning at Poole had been completed on March 10.

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9.4.51.	[redacted]	38	0.0075	0.197	1.017	0.162
14.4.51.	[redacted]	172	0.046	0.268	1.018	0.208
12.4.51.	[redacted]	202	0.020	0.099	1.013	0.106
30.6.51.	[redacted]	175	0.012	0.077	1.018	0.060
2.7.51.	[redacted]	200	0.017	0.085	1.015	0.079
"		77	0.0112	0.156	1.022	0.100

Opinion.

Four cases of sub-clinical intoxication by T.E.L. suggested by the circumstances of their exposure and supported by pathological investigations.