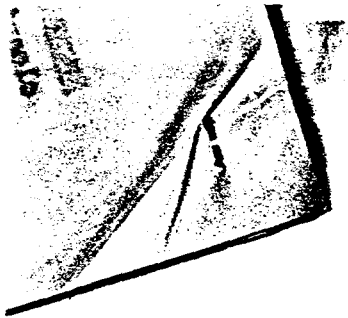
The incident was brought to light through Dr. G. Hearn, Physician, Dudley Road Hospital, Birmingham, who diagnosed correctly a case of tetraethyl lead poisoning that had been admitted to his ward on the 20th September. Representatives of the Associated Ethyl Company Limited visited the A.F.R.D. at Red Stone, near Stourport on the 26th September, to investigate the incident and to act in an advisory capacity.

Tank History.

The tank concerned in the incident is a cylindrical rivetted tank, 102 feet in diameter, 25 feet high, 4000 tons capacity, with a fixed roof, mercury sealed, and has two manholes, each approximately 30 inches in diameter, one at the bottom of the tank, and one placed eccentrically on the roof. The roof of the tank is at approximately ground level. There is a ditch approximately six feet deep, and three feet wide, in concrete, surrounding the tank. From the ditch the embankment surrounding the tank slopes steeply away to the ground level.

It was stated that Tank No. 3 was first put into commission in 1937, and used for base spirit. From 1941 to early 1947 it had contained leaded gasoline, some of which contained 5.5 c.c. T.E.L. per gallon. In late 1947 the tank was filled with water to a depth of approximately 20 feet. It was out of commission until mid-July, 1950, when the water was removed, to about one foot from the bottom. The roof man lid had been removed prior to the pumping operation. The bottom man lid was removed on the 8th August. The ventilation of the tank was that by natural wind through the two man lids. The tank had not previously been cleaned.

There



FINAL REPORT ON CASES OF TETRAETHYL LEAD INTOXICATION FROM TANK CLEANING AT ST. AUBERT, SEPTEMBER, 1950.

MEDICAL ASPECTS.

CONFIDENTIAL.

An interim report was submitted on the 29th September, 1950. In this report, notification, itinerary, tank history, certain items on tank cleaning, and the medical history of the individuals concerned were given. There were a number of discrepancies in this report, especially in respect of the duration of exposure of some of the individuals concerned. The men involved in the incident have been kept under remote observation, and certain biological samples, and samples of lead-bearing material from the tanks have been analysed.

The medical attendants of the men involved were fully informed of the clinical manifestations of tetraethyl lead poisoning and its treatment, and were given a summary of our clinical findings in each case on the 29th September, 1950. Official notification of these cases of tetraethyl lead poisoning to H.M. Chief Inspector of Factories was consequently not made by us.

the tanks have been analysed.

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prior to the pumping operation. The bottom man li
8th August. The ventilation of the tank was that
the two man lids. The tank had not previously bee

There were two other tanks in this locati
and history, referred to as Nos. 1 and 2.

Tank Cleaning Contractors.

The contractors for the tank cleaning wer
and Sons, 204 Pitsford Street, Birmingham 18.

The following notes are supplementary and c
in the interim report.

It was noted in the previous report that a
was detectable when the tank was approached on the af
26th September. This is the first occasion on which
an organic lead odour has been detectable in sludge.
not surprising that the analysis of the sludge result
high figures, far beyond any of those previously analy
This is partly due to improved methods of analysis, a
to analyse sludge samples without some loss of volati
loss has now been very considerably reduced, but it i
results shown below may still be on the low side for
be observed, from a consideration of these, that alth
which the samples were taken were all of the same con
into commission at the same time, and, so far as is kn
the storage of similar leaded gasoline, and had a sim
there is a considerable variation in the lead content
three tanks. The analysis has been repeated on seve
similar results in each. This variation in lead con
merely confirmatory to what was previously known, tha
is not homogeneous in its lead content, and that it i
from the tank construction and history whether or not
contains organic lead in such concentration as to pre
The tank concerned in the incident, No. 3, had an int
content compared with the other two. American exper
clusion that exposure of unprotected individuals to t
sludge which contained approximately 0.1% organic lea
dry weight of sludge, was likely to result in serious
the exposure was of as short a period as fifteen minu
therefore, that some individuals concerned in this in
seriously ill than they were, as the exposure to the w
contained at least 0.16% tetraethyl lead without resp
at least several hours in the case of [redacted] and
noteworthy that the completion of the cleaning of the
out by the same contractors, and that it was completed
without mishap, although one tank sludge contained 0.
lead. Constant and skilled supervision was provided
Oil Company. It is fortunate that Tank No. 3 and no
involved in the intoxication of five individuals.

% Pb due to:	Tank No. 1.	Tank No.
Tetraethyl Lead.	0.420	0.0

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% Pb due to:	Tank No. 1.	Tan No
Tetraethyl Lead.	0.420	0.
Triethyl Lead.	0.023	0.
Diethyl Lead Halides.	0.017	0.
Diethyl Lead. $(OH)_2$ & CO_3.	0.005	0.
Total Organic Pb.	0.465	0.
Inorganic Pb.	2.680	1.
Water from sludge Pb in P.p.m.		
Organic.	Nil.	0.
Inorganic.	0.7	0.

[redacted]

Aged 34, married, three children. Engineer.

This man is considered first, as he had been longest on the job of cleaning three tanks at Stourport. He had been previously engaged in cleaning tanks at Red Mile, in Nottingham, in August, 1950, in which the safety precautions were not observed. He did not suffer any ill-effects from this misdemeanour. He took over the job of cleaning No. 3 Tank at Stourport from his brother, [redacted] on the 13th September, 1950. He was examined first on the 26th September, and again on the 1st December. He was of the opinion that his brother had given in too easily, and on the last examination still thought it was possible to work off the symptoms. When he first took over from his brother, he wore protective clothing, sometimes over his ordinary street clothing, and a positive pressure full face air line mask most of the time when in the tank, but took it off when it became cumbersome. On the afternoon of the first day he was in the tank, the 13th September, he developed abdominal discomfort and pain, and was sleepless that night. The following day, his vision, normally defective became worse, and he saw double at times. He felt weak, and tired easily. His appetite became poor. He felt nauseated all the time, but was unable to vomit. He tried to force himself to eat. A dull frontal headache developed, and he noticed that he had become pale. Diarrhoea ensued, and became severe. On the 15th September, all the symptoms became worse, and about this time "telephone bells" seemed to be ringing continuously in his ears. On Saturday, 16th September, he remained in bed. A very severe pain had developed in the "pit of his stomach," and he spent most of the day tossing about the bed with pain. He was perspiring very freely about this time. The diarrhoea continued in a severe form. He took some hot milk that evening, and shortly after the severe abdominal pain eased, leaving a soreness, but the perspiration increased. His gums were sore, and he had a very bad taste

[redacted]

The concentration of organic lead in sludge water in tank No. 3, i.e. 2.82%, is, in our opinion, about saturation point under the conditions existing at that time.

Medical History of Individuals.

The five individuals concerned in this incident were the two sons of the contractors, Messrs. [redacted] Whelan and Sons, [redacted] and [redacted], and the employees [redacted], [redacted] and [redacted]. The contractor, [redacted], while presenting no symptoms or signs of intoxication, is included in the case histories to illustrate one point.

[redacted]

[redacted], while presenting no symptoms of illness [illegible] included in the case histories to illustrate one poi

[redacted]

Aged 34, married, three children. Engin

This man is considered first, as he had b of cleaning three tanks at Stourport. He had been cleaning tanks at Red Hills, in Nottingham, in August safety precautions were not observed. He did not from this misdemeanour. He took over the job of cl Stourport from his brother, M.J. Whelan, on the 13th was examined first on the 26th September, and again He was of the opinion that his brother had given in last examination still thought it was possible to w When he first took over from his brother, he wore p sometimes over his ordinary street clothing, and a p face air line mask most of the time when in the tank it became cumbersome. On the afternoon of the firs the 13th September, he developed abdominal discomfor sleepless that night. The following day, his visio became worse, and he saw double at times. He felt His appetite became poor. He felt nauseated all th vomit. He tried to force himself to eat. A dull and he noticed that he had become pale. Diarrhoea severe. On the 15th September, all the symptoms be this time "telephone bells" seemed to be ringing con On Saturday, 16th September, he remained in bed. developed in the "pit of his stomach," and he spent about the bed with pain. He was perspiring very fr The diarrhoea continued in a severe form. He took and shortly after the severe abdominal pain eased, the perspiration increased. His gums were sore, an in his mouth. Severe muscular twitchings, which he present at this time, and he had some itching of the the face and hands. He forced himself to return to but with the other men, Coates and Cascoigne, found and when materials from the tank were handled, full observed. On the 25th and 26th September, he enter did not admit any terrifying dreams, but stated on t had not slept since he started tank cleaning on 13th

On examination on the 26th September, afte the tank, and had bathed and changed, he was noted had some twitching of his facial muscles, especially

Subsequent to this examination, he remai
away from tank cleaning for two weeks, after which
other employees who had recommenced the cleaning.
Company supervisor that he was perfectly all right
persistent leading questions, he finally admitted
that he had not been symptom-free, and, moreover,
from time to time, although mostly in the open.
still pale, visibly thinner, and still had a marke
bad taste in the mouth was persistent, and he was
chewing mints to counteract it. He was still sle
irritable. The frontal headache had persisted, t
and he still had severe involuntary twitchings and
There had been loss of libido since the onset. H
tired, but one learned subsequently that when the
about the 14th December, he immediately went to be

The medical attendant of this man had be
condition on the 29th September, and he had been g
he took intermittently from the 29th September.
copious intake of fluid, he had no other treatment

On the 1st December, there were no abnor
Blood pressure 110/70. Temperature 97.6. Pulse
Blood films, 105 stippled cells per million R.B.C.
The lead concentrations in urine and blood are giv

Date.	Urine.				
	Vol. of Sample. (mls.)	Mgm. Pb.		S.G. at 20°C.	Standar dised. Mg./lit 1.014.
		Sample.	Per litre.		
26. 9.50.	115	.098	.851	1.027	.443
27. 9.50.	275	.126	.458	1.022	.292
12.10.50.	45	.036	.800	1.019	.589
13.10.50.	91	.042	.462	1.014	.462
10.11.50.	370	.062	.168	1.009	.261
1.12.50.	185	.051	.276	1.009	.430

Comment.

It will be seen that in this and subsequ

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condition on the 29th September, and he had been give
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13.10.50.	91	.042	.462	1.014	.282
10.11.50.	370	.062	.168	1.009	.101
1.12.50.	165	.051	.276	1.009	.130

Comment.

It will be seen that in this and subsequent
diagnosis was made on clinical grounds, and confirmed
a persistent increase in the excretion of lead in the
cases an increased lead content in the blood. It m
the diagnosis was made on the general clinical pictur
on any particular symptom or finding. It will be se
pressure, temperature, pulse rate and stippled cell co
in these cases.

In this particular case, it would have been
individual, and in fact at one stage it was possible
the layman as to the true condition of his health. T

of his sibling, [redacted] may be seen, but at no
encountered. If anything, his exposure was not so
prolonged, and was repeated before he was symptom-fr
urinary excretion of lead was consistently within no
severity of the alimentary symptoms is noteworthy.
has been occasionally encountered in similar cases i
not always been present. The itching of the skin w
in the original non-fatal cases reported by him. I
in reports of cases of intoxication since.

In this and in the subsequent cases, every
was taken to prevent contamination of the specimens
obtained for analysis, and we feel that the samples
not contaminated, as samples taken from blenders in
at the same time, gave normal findings. The lead e
this man, [redacted] will be observed to be very v
four samples, taken between the 25th September and 1
were at a level rarely encountered, and indeed the h
associated with a much more severe illness than pres
It will be seen, from consideration of the lead excr
individual, and of the other men in this series, the
urine is a very indifferent guide as to the severity
manifestations. One of the others had a lower rate
yet had more severe symptoms. It is desirable also
even at the lower rates of excretion, such as on the
1st December, this man presented the symptoms of tet
We have previously expressed the opinion that no gre
given to the result of a single sample of urine, and
series is desirable before any opinion is given. T
evidence of this statement in the analytical results
Further consideration of the lowest common denominat
excretion in urine will be given later in this repor

KE 0021373

[redacted]

Aged 38. Married. One child. Enginee

The history of this man has been partly ob

He had been engaged on tank cleaning at Ne
and did not take any precautions. He did not suffe
to health as a result. He had apparently been pres
Stourport in the week prior to which the actual tank
commenced, and probably between the 6th and 8th Sept
proper was commenced with B. Cart on the afternoon o
It is possible that he started off wearing a respira
it, as the sight glasses steamed up. The carburett
became blocked, and it was replaced by the one in th
He did not bother to bath or change his underwear

obtained for [redacted] not contaminated, as samples taken from blenders in at the same time, gave normal findings. The lead e this man, [redacted] will be observed to be very v four samples, taken between the 25th September and 1 were at a level rarely encountered, and indeed the h associated with a much more severe illness than pres It will be seen, from consideration of the lead excr individual, and of the other men in this series, tha urine is a very indifferent guide as to the severity manifestations. One of the others had a lower rate yet had more severe symptoms. It is desirable also even at the lower rates of excretion, such as on the 1st December, this man presented the symptoms of tet We have previously expressed the opinion that no gre given to the result of a single sample of urine, and series is desirable before any opinion is given. T evidence of this statement in the analytical results Further consideration of the lowest common denomina excretion in urine will be given later in this repor

[redacted]

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He had been engaged on tank cleaning at [redacted] and did not take any precautions. He did not suffe to health as a result. He had apparently been pres Stourport in the week prior to which the actual tank commenced, and probably between the 6th and 8th Sept proper was commenced with [redacted] on the afternoon It is possible that he started off wearing a respira it, as the sight glasses steamed up. The carburett became blocked, and it was replaced by the one in th He did not bother to bath or change his undergarment working period on the 11th September. He stated th smell in the tank when he entered, and although it w on working.

The first symptom he noticed was abdominal progressed to pain, and was quickly followed by inte diarrhoea, which necessitated his leaving the tank i

his ears, "pins and needles" in the face and hand
our last examination on the 1st December. He b
confused. Giddiness was severe, especially on m
persisted to the date of the last examination.
ednesday, 13th September, and spent most of his
persisted, and continued to be severe. While wa
surgery on the 18th September, he had a violent 'f
and was admitted to hospital the same evening, wh
weeks.

On admission to hospital, he was confus
diagnosed as psychosis of unknown origin. Apart
he remains amnestic for a period of two weeks, of
On admission, Blood pressure 140/60. Temperatur
On admission, he was found to be markedly mentally
restless, anxious and apprehensive. There was a
tongue and face. He was given 5 c.c. of paralde
other mild barbiturates by mouth, with no effect.
intensive treatment in hospital. He kept all th
awake for a few nights, and would have been refer
had not his condition been subject to very marked
Shortly after admission, he shouted out, " I have
poisoning. I am dying. Four other men have di
he said, "You had better get the other four men i
is making me better." Later, apparently, he got
and down the ward without his pyjama trousers on.
a nurse, and made attempts to throw water over th
another occasion, he made a dash for the ward cor
going to stop the children crying outside.

When seen on the 1st December, he had a
aberrations of behaviour, and tried to justify hi
he "had to stop those nurses running up and down
the children were crying in an adjacent children'

When his father visited him on the 24th
go away, then to lift the bed, and when his pillo
he was very abusive, and repeated his desire to h
His father was very distressed at his condition,
insane. He was, moreover, confirmed in this bel
enquired of him whether or not there was mental t

When examined on the 27th September, Mi
lucid, but had some defect in memory, especially
could not remember [redacted], nor was he at all
order of tank cleaning. He did not understand w
wear respiratory protection when there was a man
the tank and another at the top, with the wind bl
he had to get the job done if he were going to ma
more difficult to work with protection. He was

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wear respiratory protection when there was a man bol
the tank and another at the top, with the wind blowi
he had to get the job done if he were going to make
more difficult to work with protection. He was en
the Company's regulations, on tank cleaning, which h
hospital.

Hospital Investigations.

20.9.50. Haemoglobin 104%. W.B.C. 4,20
Reticulocytes 1%. No stippled cells.
X-ray chest. "Calcified focus in the rig
active disease."

23.9.50. C.S.F. 3 cells. Protein 20

was 90%. Stippled cells 160 per million. E.C.G. excretion in urine and blood is shown below.

Date and Time.	Urine.				
	Vol. of Sample. (mls.)	Mgm. Pb.		S.G. at 20°.	Standardised. Mg./litre 1.014.
		Sample.	Litre.		
4.10.50. 1330	330	0.076	0.230	1.011	.293
4.10.50. 1730	360	0.084	0.233	1.009	.363
4.10.50. 2150	395	0.108	0.276	1.011	.351
5.10.50. 0830	347	0.148	0.426	1.014	.426
5.10.50. 1400	390	0.062	0.188	1.006	.439
5.10.50. 1445	400	0.062	0.155	1.003	.722
5.10.50. 1530	340	0.046	0.135	1.003	.632
26.10.50.	320	0.132	0.413	1.020	.288
31.10.50.	114	0.018	0.158	1.007	.316
15.11.50.	247	0.079	0.320	1.023	.195
1.12.50.	383	0.034	0.090	1.009	.127

Comment.

This man had probably had the most intens men involved. He definitely had developed frank s encephalopathy, but even when he was actually ill, t urine in early October was at a level not usually a marked symptoms, although on two subsequent occasio 26th October, lead excretion in urine was at a very 1st December, 80 days after removal from exposure, man still had symptoms, and although the excretion within normal limits, his blood lead content was ap is here accepted as the maximum under normal condit sideration will indicate how important it is that a blood should be taken at the same time. One sampl case of this man might lead one to conclude that th feigned, but the abnormal quantity of lead found in one sample was taken, is sufficient confirmatory ev past history, to make his story acceptable.

Two other points of note in this case are tetraethyl lead poisoning was not made until the at medical authorities was drawn to it, no regard havi statement that he was suffering from lead poisoning diarrhoea from which he suffered in the initial sta the blood pressure, pulse rate and temperature reco

made him feel sick and gi y after a short time. He has no recollection
of how he felt on the 11t September, but the following day he felt very
wea in on that night, but
had res s h could r d diarrhoea ensued
abo is saw is own no e had "nerves",
and him sleep tab te. He eel tiffness in his legs,
and sionally saw e p n. His n becam urred, and a frontal
headac developed. lat , he had numbness and tingling in the hands and
feet. A dry cough, hic is still present, developed, and was associated
with pain across the hou ers. He returned to work about the 13th, but
the smell of the pot l c sed nausea and vomiting. H developed severe
abdominal pain, and s a itted to hospital on the 20t September for this.
Dysuria (difficulty in passing urine) was marked at thi time, and morphia
was required for its relief. At this time, he also h d violent "starts
and twitchings", and his hands were very "shaky." In hospital, he passed
blood in his urine.

On examination on the 27th September, he looked pale, was very depressed, and slightly disorientated. Blood pressure 130/90. Temperature 97.8. Pulse rate 82. He complained of difficulty in passing water. His memory for recent events was poor. There were no abnormal findings in examination.

Hospital Investigations.

21. 9.50. 1. Haemoglobin 116%, red blood cells 5,360,000, white blood cells 10,500. Normal differential count.

2. Cerebro-spinal fluid - clear colourless fluid. Cells less than 1/ cu.mm. Protein - 30 mgms.%. Lead content - nil.

23.9.50. Blood Urea - 30 mgms. %.

On examination on the 27th September, he looked pale, was very depressed, and slightly disorientated. Blood pressure 130/90. Temperature 97.8. Pulse rate 82. He complained of difficulty in passing water. His memory for recent events was poor. There were no abnormal findings in examination.

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2. Cerebro-spinal fluid - clear colourless fluid. Cells less than 1/ cu.mm. Protein - 30 mgms.%. Lead content - nil.

23.9.50. Blood Urea - 30 mgms. %.

26.9.50. Urine - N.A.D.

27.9.50. 1. Urine - red blood cells and occasional hyaline casts.

2. Blood Urea - 33 mgms. %.

3. Urea clearance - 120% of normal.

7.11.50. Haemoglobin 97%, red blood cells 4.9 million.

B.P. 140/70. Urine - normal.

ough [redacted] was incomplete [redacted] subsequent co-operation made the records of this case reasonably complete. This man had probably approximately the same exposure as [redacted] possibly a little less, but certainly he was exposed to a concentration of lead vapour from the sludge [illegible] a lead content in excess of 0.1% of organic lead, based on the dry weight, without respiratory protection, for several hours. Part of the history given by him when first seen in hospital was subsequently found to be incorrect. From what one could learn, he had been engaged in tank cleaning at the location in Nottingham with the Whelans, and had not suffered any ill-effects from non-observance of the essential precautions. He did not wear respiratory protection at any time in the tank cleaning at Stourport. It is probable that he was present there, and was in and out of the tank, with Michael Whelan between the 6th and 8th September, and he entered the tank with Michael Whelan on the afternoon of the 11th September. He was slightly indignant at the "suggestion" of the advisability of wearing a respirator and other protection, and he stated that respirators always steamed up, and made him feel uncomfortable. He admitted th[illegible] th[illegible]dour in [illegible] tank made him feel sick and giddy after a short time. He ha[illegible] no rec[illegible]tion of how he felt on the 11th September, but the following day he f[illegible]ery weak at midday, had no inclination for food, slept badly that ni[illegible] but had no dreams as far as he could remember. Vomiting and diarrhoea an[illegible]d about this time. He saw his own doctor, who told him he had "nerves" and gave him sleeping tablets. He had a feeling of stiffness in his [illegible]s, and occasionally severe pain. His vision became blurred, and a fronta[illegible] headache developed. Later, he had numbness and tingling in the hands [illegible]d feet. A dry cough, which is still present, developed, and was [illegible]soci[illegible]d with pain across the shoulders. He returned to work about the 18th, but the smell of the petrol caused nausea and vomiting. He developed severe a[illegible]ominal [illegible]ain, and was admitted to hospital on the 20th September for this. D[illegible]uria ([illegible]fficulty in passing urine) was marked at this time, and morphia w[illegible] requir[illegible]d for its[illegible] relief. At this time, he also had violent "starts and twitch[illegible]ngs", and his hands were very "chalky." In hospital, he passed blood in his urine.

cough. He had lost one and a half stones in weig
gained one stone. He was sleeping better, but no
sily, although he had not returned to work. He a
emonia a few years ago. The X-ray of this man,
corded in the findings, did not show any evidence
ler and thinner than when seen in hospitol. Bloo
Temperature 97.8, Pulse rate 76. Haemoglobin 97% (
cells. E.C.G. normal. No abnormal signs were det
The concentration of lead in urine, faeces and blood

	Urine.				
	Vol. of Sample. (mls.)	Mgm. Pb. Sample.	Mgm. Pb. Litre.	S.G. at 20°.	Standard ised. Mg./litr
27. 9.50. 2115	176	0.260	1.48	1.013	1.590
27. 9.50. 2240	276	0.230	0.833	1.008	1.456
27. 9.50. 2400	350	0.170	0.486	1.004	1.700
27/28.9.50.	216	0.330	1.759	1.014	1.759
27/28.9.50.	288	0.450	1.973	1.016	1.730
27/28.9.50.	408	0.210	0.514	1.004	1.795
27/28.9.50.	330	0.150	0.454	1.002	3.180
27/28.9.50.	350	0.170	0.486	1.005	1.360
27/28.9.50.	375	0.240	0.641	1.004	2.240
27/28.9.50. —	270	0.180	0.666	1.005	1.860
28. 9.50. 0435	299	0.300	1.000	1.010	1.400
1.10.50.					
23.10.50.1017	292	0.037	0.127	1.004	0.443
23.10.50. 1143	305	0.023	0.075	1.002	0.526
23.10.50. 1253	350	0.034	0.097	1.003	0.453
23.10.50. 1700	318	0.042	0.132	1.003	0.696
23.10.50. 1715	325	0.091	0.270	1.009	0.436
23.10.50. 2245	375	0.079	0.211	1.006	0.493
24.10.50. 0630	265	0.085	0.321	1.013	0.345
16.11.50.	233	0.047	0.202	1.013	0.217
1.12.50.	170	0.020	0.118	1.013	0.127

Faeces.

Date.	Ash. Wt. gm.	Mg. Pb. Sample.	Mg. Pb 1 gm.
28. 9.50.	0.34	0.230	0.67
1.10.50.	1.81	0,680	0.37

27. 9.50. 2115	176	0.260	1.48	1.013	1.590
27. 9.50. 2240	276	0.230	0.833	1.008	1.456
27. 9.50. 2400	350	0.170	0.486	1.004	1.700
27/28.9.50.	216	0.330	1.759	1.014	1.759
27/28.9.50.	228	0.450	1.973	1.016	1.730
27/28.9.50.	408	0.210	0.514	1.004	1.795
27/28.9.50.	330	0.150	0.454	1.002	3.180
27/28.9.50.	350	0.170	0.486	1.005	1.360
27/28.9.50.	375	0.240	0.641	1.004	2.240
27/28.9.50.	270	0.180	0.666	1.005	1.360
28. 9.50. 0435	299	0.300	1.000	1.010	1.400
1.10.50.					
23.10.50.1017	292	0.037	0.127	1.004	0.443
23.10.50. 1143	305	0.023	0.075	1.002	0.526
23.10.50. 1258	350	0.034	0.097	1.003	0.353
23.10.50. 1700	318	0.042	0.132	1.003	0.896
23.10.50. 1715	325	0.091	0.270	1.009	0.436
23.10.50. 2245	375	0.079	0.211	1.006	0.493
24.10.50. 0630	265	0.085	0.321	1.013	0.345
16.11.50.	233	0.047	0.202	1.013	0.217
1.12.50.	170	0.020	0.118	1.013	0.127

Faeces.

Date.	Ash. Wt. gm.	Mg. Pb. Sample.	Mg. P 1 gm.
28. 9.50.	0.34	0.230	0.6
1.10.50.	1.81	0.680	0.3

Comment.

This man, who had an intense exposure, an lead in urine was at times at a very high level, in concentrations have only very rarely been encountered not at any time exhibit symptoms of frank lead excep in this case which requires note is the presence of A similar condition was described by Inder Singh in in 1945. The cause of this is obscure, and it cer have left any permanent disability. It should be symptom for which this man was admitted to hospital

[redacted]

Aged 31. Married. No Children. Pipe

The history given by this man, although v
subsequently to have discrepancies. He was appare
J. Whelan and Sons, but had been engaged on the tan
in mid August, although he had not had a great deal
joined [redacted] and [redacted] n the 11th September,
the tank. He did not have respiratory protection,
protective clothing of sorts over his ordinary work

This man stated that he felt well on the
11th and 12th September, but on Wednesday, 13th Sep
and had cold "spells", especially in the shoulders.
had bad dreams. Although he did not admit vomitin
observers stated that they had seen him outside the
bank, retching and vomiting on one or other of thes
retching and vomiting in the tank on Wednesday, and
subject of some mirth to [redacted] who had start
On the 13th also he had "a taste like a penny in hi
he did not go to Stourport. His symptoms remained
sleeplessness became more severe. On the 15th he
who, he said, told him that he was "a bundle of ner
nothing wrong with him. He stayed away from work
the symptoms remaining more or less the same at thi
thd afternoon of the 17th, following retching throu
a very vivid dream that evening, but not particular
few short intervals of sleep that he had, he appare
returned to work at Stourport on the 18th, although
his breakfast that morning. He worked away from t
on the pit that had been excavated for sludge. Th
nausea, and he returned home. On the 19th, he wor
Birmingham, but felt very weak and tired easily.
heavy, and he felt cold and aching all over, partic
thighs, which were also stiff. He felt and saw tw
at this time. Some of these caused quite violent
apparently at Stourport again on the 20th and 21st,
days is known. He suffered from palpitations of t
the other symptoms remaining at more or less the sa
appetite at the weekend, 23rd to 24th September, an
started to have diarrhoea, which was still present
He went to the cinema on the 23rd, and had difficul
He had the feeling all the time that he was very fa
He slept badly on the 25th and 26th. His appetite
latter day he stated that he had a violent pain in
from the time he got up, and that it was still pres
in the muscles, and not internal. Intermittently

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joined [redacted] and [redacted] on the 11th September, a
the tank. He did not have respiratory protection, a
protective clothing of sorts over his ordinary workin

This man stated that he felt well on the M
11th and 12th September, but on Wednesday, 13th Sept
and had cold "spells", especially in the shoulders.
had bad dreams. Although he did not admit vomiting
observers stated that they had seen him outside the
bank, retching and vomiting on one or other of these
retching and vomiting in the tank on Wednesday, and
subject of some mirth to [redacted] who had started
On the 13th also he had "a taste like a penny in his
he did not go to Stourport. His symptoms remained
sleeplessness became more severe. On the 15th he w
who, he said, told him that he was "a bundle of nerv
nothing wrong with him. He stayed away from work
the symptoms remaining more or less the same at this
the afternoon of the 17th, following retching throug
a very vivid dream that evening, but not particularly
few short intervals of sleep that he had, he apparen
returned to work at Stourport on the 18th, although
his breakfast that morning. He worked away from th
on the pit that had been excavated for sludge. The
nausea, and he returned home. On the 19th, he work
Birmingham, but felt very weak and tired easily. H
heavy, and he felt cold and aching all over, particu
thighs, which were also stiff. He felt and saw twi
at this time. Some of these caused quite violent "
apparently at Stourport again on the 20th and 21st,
days is known. He suffered from palpitations of th
the other symptoms remaining at more or less the sam
appetite at the weekend, 23rd to 24th September, and
started to have diarrhoea, which was still present o
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He had the feeling all the time that he was very far
He slept badly on the 25th and 26th. His appetite
latter day he stated that he had a violent pain in t
from the time he got up, and that it was still prese
in the muscles, and not internal. Intermittently,
had had a rash on his left leg before starting the t
stated that since the sludge got on to it, it had be
he had had violent pains in his toes on that side, w
scream out at times with their intensity.

From his own statement, he was apparently
nature of the hazard in tank cleaning, and although
not right, he could not make up his mind just what w
remaining on the job and with Wholans only until the

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Date.	Vol. Mls.	Mgs. Pb/Sample.	Mg. Pb/litre	S.G. at 20°.	Standardised. Mg/litre 1.014.
26. 9.50.	122	0.126	1.030	1.029	0.500
13.10.50.	42	0.018	0.429	1.022	0.273

Comment.

This man gave a very clear history in chronological order, without prompting, and required very few leading questions, yet some of his story was subsequently found to be incorrect. Again, although the two samples of urine show concentrations of lead at a very high level, no signs of lead encephalopathy were detected, nor, from our present knowledge, did they develop subsequently. As far as can be ascertained, his exposure was not of the same order as that of the two Whelans and Cert. One's impression is that the rash on his leg may have been irritated by the sludge coming into contact with it. The abdominal pain of which he complained on the 26th September did appear to be muscular, and was, in our opinion, very severe. There is nothing else unusual [illegible] in this story.

From his story, little attention had been paid to bathing, and he had retained his soiled works clothes, which he said smelled of the sludge, at his home.

On examination, he was found to be a man of small physique, pale, had an anxious look, and was tense and apprehensive. Blood pressure 120/90. Temperature 97.2. Pulse rate 60. Blood film normal. Stippled cells - nil. Haemoglobin (Sahli) 93%. There was a marked coarse tremor of the left hand, and twitching of the face, especially around the mouth. The tongue was heavily furred and tremulous. A small area of dermatitis was present on the left leg, which appeared to be healing. The central muscles of the abdomen, especially below the naval, were extremely tender, and he winced and squirmed even on light touch. No other physical signs were found. The reflexes were normal.

This man left the employment of the contractor soon afterwards, and had no further experience in tank cleaning. He was stated to be at work elsewhere, and to have made a complete recovery on enquiry on the 1st December, 1950, but this statement has not been confirmed.

Samples of urine obtained from him on two occasions were analysed with the following results.

work elsewhere, and to have made a complete recov
1st December, 1950, but this statement has not be

Samples of urine obtained from him on t
with the following results.

Date.	Vol. Mls.	Mgms. Pb/Sample.	Mg.
26. 9.50.	122	0.126	1
13.10.50.	42	0.018	0

Comment.

This man gave a very clear history in c
without prompting, and required very few leading
his story was subsequently found to be incorrect.
two samples of urine show concentrations of lead
no signs of lead encephalopathy were detected, no
did they develop subsequently. As far as can be
was not of the same order as that of the two whol
impression is that the rash on his leg may have b
sludge coming into contact with it. The abdomin
complained on the 26th September did appear to be
our opinion, very severe. There is nothing else
story.

[redacted]

Aged 23. Single. Fitter.

This man had only been employed by the
weeks at the time of the examination. He had no
tank cleaning in Nottingham, and he started tank
the 14th September, when he was mainly engaged in
On the 15th, he was inside, after most of the slu
mainly scraping up sludge that was adhering to th
he wore a full face air line respirator. He had
sorts. As far as can be ascertained, he wore co
became soiled during the process of cleaning. A

Date.	Vol. (mls.)	Mgm. Pb. Sample.	Mgm. Pb. Per litre.	S.G. at 20°.	Standardised. Mg.Pb/litre. 1.014.
26. 9.50.	320	.068	.212	1.012	0.248
12. 10.50.	27	.010	.369	1.022	0.247
13.10.50.	282	.066	.234	1.020	0.164
10.11.50.	330	.058	.176	1.016	0.154
1.12.50.	46	.013	.298	1.027	0.155

Comment.

Again, the diagnosis had to be made on clinical grounds, but was confirmed later by the analysis of samples of urine. Again blood pressure, temperature and pulse rate, as in the other cases, were of little value. The lead excretions in urine, on the five occasions on which samples were obtained, are seen to be in all cases above normal, in fact on the 1st December, when the individual was symptom-free, the excretion of lead in urine was at a higher level than when the symptoms were present on the 26th September. It is possible that this individual, who had subsequent exposure in tank cleaning, had absorbed further significant amounts of lead, and therefore no comment on the continued excretion of lead at a level higher than normal is warranted.

he drank a lot of beer on the evening of the 15th September, and, contrary to his usual custom after such a debauch, he slept badly that night. On the 17th, he was restless all day, had little inclination for food, and that night did not sleep. On the 18th and 19th he did not go to work. His appetite remained poor, but he slept at night, and had no dreams. On the 20th he returned to Stourport. He does not remember how he felt that day, but he had still little inclination for food. On the 21st, he was not at Stourport, but that night had a dream which he remembers vividly, and in which he had to eat maggots. On the 22nd, he saw double, and that evening he had a dream in which he was in a long, dark tunnel, and as he walked down this tunnel he became smaller and smaller. On the 25th he returned to Stourport on the tank cleaning. This day he felt twitchings in his muscles. He slept better that night than he had done for the past week, and his appetite had slightly improved.

On examination on the 26th September, he was of normal appearance. Blood pressure 130/95. Temperature 96.6. Pulse rate 77. Haemoglobin (Sahli) 100%. Blood film normal. No stippled cells found. His pupils were unequal, the left being smaller than the right, but no other abnormal signs were found.

Subsequently, he remained at work away from tank cleaning for a fortnight, but returned to tank cleaning after this time, symptom-free and under skilled supervision. On the 1st December, no symptoms were admitted, and he stated that he felt well. He was of normal appearance. Blood pressure 120/80. Temperature 98.2. Pulse rate 70. Haemoglobin (Sahli) 97%. Blood film - normal. No stippled cells found. The excretion of lead in urine in this man is shown below.

blood pressure for some years.

On examination he was seen to be very wel
years, and of normal appearance. Blood pressure l
Pulse rate 68. Haemoglobin (Sahli) 106%. Blood
stippled cells seen. The lead excretion in urine

Date.	Vol. (mls.)	Mgm. Pb.		S.G. at 20
		Sample.	Per litre.	
27. 9.50.	295	.029	.114	1.022
12.10.50.	44	.004	.107	1.023
10.11.50.	68	.006	.097	1.022

Comment.

It will be seen that in the three instanc
of urine were obtained from this man, the concentra
within normal limits, is at the upper limit of norm
which is an unusual finding in our experience, and
is an indication that he had some significant absor
Nottingham, which caused the excretion of lead at a
normal, but which was not sufficient to give rise t
that the other individuals engaged in tank cleaning
absorbed significant amounts of lead during the tan
there.

Name.	Intensity of Exposure.	Clinical Manifestations.	Lead Excretion.
[redacted]	1	1	4
	2	2	1
	3	3	3
	4	4	2
	5	5	5

The residual symptoms cannot be related to the items tabulated above, as two of the individuals concerned had probably subsequent exposure, but at no time at such an intense degree as in the cases of [redacted] and [redacted]. In the one case in which frank encephalopathy developed, the urinary excretion of lead was a poor indication of the severity of the condition. The individual with the highest lead excretion in urine had most marked symptoms referred to the urinary tract, and not to the central nervous system.

The clinical pictures described are similar to those published in the literature, namely sleep disturbances, loss of appetite, muscular pain and twitchings, diarrhoea, and various abnormal sensations of taste and on the body. Particular in this series are the severity and persistance of abdominal pain and diarrhoea, the intensity of perspiration in one case, and the presence of haematuria in another. The temperature, pulse rate and blood pressure readings were of little value, and were not depressed.

[redacted]

Summary and Conclusions.

Three tanks of similar construction and service, which had contained leaded gasoline, are shown to have contained sludge with great variability in the organic lead content, and the cleaning of one of these, which had a tetraethyl lead content of 0.16%, resulted in the intoxication of five individuals, through non-observance of the regulations governing tank cleaning. One case of encephalopathy developed about one week after the last exposure. Exposure in all cases was at least for several hours. An odour of organic lead was easily detectable in the sludge from the tank concerned.

In the five cases of intoxication, the clinical manifestations were in direct proportion to the intensity and degree of exposure. The lead excretion in the individuals concerned cannot be directly related to the intensity of exposure and clinical manifestations. This may not be clear from the clinical pictures recorded, but our clinical impression is tabulated below.

Name.	Intensity of Exposure.	Clinical Manifestation
[redacted]	1	1
[redacted]	2	2
[redacted]	3	3
[redacted]	4	4
[redacted]	5	5

The residual symptoms cannot be related to above, as two of the individuals concerned had probal but at no time at such an intense degree as in the c B. Cart. In the one case in which frank encephalop urinary excretion of lead was a poor indication of t condition. The individual with the highest lead ex most marked symptoms referred to the urinary tract, nervous system.

The clinical pictures described are simila in the literature, namely sleep disturbances, loss o pain and twitchings, diarrhoea, and various abnormal ani on the body. Particular in this series are the of abdominal pain and diarrhoea, the intensity of pa and the presence of haematuria in another. The tem and blood pressure readings were of little value, an as is usually found in tetraethyl lead poisoning. present in some cases more than two months after rem sleep disturbances, loss of appetite, aberrations of giddiness being the most persistent symptoms. The in all cases, very few or none.

It is noteworthy that none of these cases The two hospitalised cases were given a high fluid i doses of sedatives.

The lowest common denominator" for mean le if used as an indicator of the degree of lead absorp less than 0.2 mgm. per litre, if symptoms of lead in avoided.

KE · 0021389

E. Davison.
Medical Department.
19th January, 1951.

RE 0021390

When competent and independent supervision was provided, tank cleaning on the Stourport site was completed without mishap, although one of the tanks concerned contained more than double the percentage of volatile lead than the tank which gave rise to the intoxication. It should be clear that it is impossible to predict, from the history of tanks which contained leaded gasoline, whether or not the sludge of these is likely to be toxic, as the concentration of organic lead in the sludge of these is very variable, and therefore it is essential that the regulations be observed in all cases, until such times as expert opinion and equipment are available to estimate the degree of hazard. This, in any case, can only apply to small tanks, and, as far as U.K. is concerned, the regulations should be observed for all tanks, and tank cleaning carried out only under competent and independent supervision.

N.B. The concentrations of lead in urine referred to in the above report are the concentrations of milligrammes per litre, and not the standardised figures. A considered normal mean in U.K. is 0.03 mgm. per litre, with concentrations above 0.08 mgm. per litre uncommon, and under normal conditions never in excess of 0.12 mgm. per litre. The mean lead concentration in blood is about 0.027 mgm. per 100 grammes of whole blood, with the upper limit below 0.07 mgm. per 100 grammes. Any concentration above 0.055 mgm. is suspicious.